Vol. XIX No. 1

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ANN ARBOR, MICHIGAN: 1958

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AGRICULTURE, GENERAL

AN EVALUATION OF SOIL SPLASH AS A FACTOR IN SOIL EROSION

(L. C. Card No. Mic 58-2432)

Ananda Kumar Bhattacharyya, Ph.D.
Cornell University, 1958

Splashing of soil by raindrops as they strike bare soil has been studied and described by various workers as a factor in soil erosion. Their failure to recognize the cancelling effect of back-splash, which would occur in a field but not in the small isolated pans normally used for splash investigation, has led to the acceptance of splashing as a primary factor in erosion and as a process of erosion by itself. Experiments have been conducted here to support the contention that isolated pan experiments are unsound to evaluate the relationship between amount of splashed material and run-off or soil loss in run-off. Two basic soil materials were used: commercial sand, and Honeoye silt loam from a field in poor physical condition. A portion of the latter was treated with a soil conditioner to improve its state of aggregation, making the third "soil" used in the study. The three soils were used with simulated rainfall. Isolated runoff plots (i.e., back-splash restricted) and run-off plots placed at the center of a large guard area of similar soil (unrestricted back-splash) were compared in terms of soil loss by splashing (i.e., net splash losses from the run-off plots), soil splash in a unit area within the run-off plot, run-off, infiltration and run-off soil loss.

In these studies, splashing in a unit area was determined by collecting material splashed into small (4-cm diameter) cylinders placed at the center of each run-off plot. This material under non-restricted conditions was assumed to be equal to that which would have been lost from soil occupying the same cylinder space. Under restricted conditions, however, this material was assumed to represent the amount that would have been splashed from this space within the area of run-off plot.

Despite careful preparation, contrasts between the two back-splash conditions were mainly limited to secondary factors. Partial failure to realize the primary objective was attributed to dissimilarity of splashing patterns due to surface run-off. Because of the larger "watershed" of the guard area, the depth of surface run-off present in the guard area was always greater, once run-off commenced, than in the run-off plot, which had its own run-off outlet. This effect was so large that in all three soils tested, the measured splash for the restricted back-splash could not be distinguished, statistically, from that measured with non-restricted back-splash. In other words, the surface water in the guard area served to effectively restrict back splash from that area.

Study of the results reveals interesting relationships of secondary importance: Amount of splash is dependent on soil-water relations of the soil. This dependence varies with the physical characteristics of the soil particles and aggregates. The total splashed materials collected from the soils did not show any correlation between amount of splash and size distribution of soil particles, or aggregate stability.

All the soils under restricted back-splash had less infiltration and more surface run-off than the corresponding soils under non-restricted back-splash.

Untreated soil lost more soil in run-off where splash particles were removed from the run-off plot than from the plots where splashed-out particles were replaced by splashed-back particles. Run-off soil loss results of stabilized soils under two "splash" conditions showed the same relationship as that of untreated soil, despite the fact that under non-restricted conditions the lost soil particles from the run-off plot were only partially replaced from the guard area. Run-off soil loss results for sand under the two conditions, however, showed the reverse relationship. The total net splash losses from the run-off plots were the same in sand, for both methods.

115 pages. $2.00.

EVALUATION OF ALTERNATIVE ALGEBRAIC FORMS FOR PRODUCTION FUNCTIONS

(L. C. Card No. Mic 58-2184)

John Philip Doll, Ph.D.
Iowa State College, 1958

Supervisor: Dr. Earl O. Heady

Experiments designed to estimate continuous response functions must include a wide range of variable inputs if economic optima are to be derived. However, predictions of various mathematical forms of production functions fitted to this type of experimental data often differ. The objectives of this study were to determine (1) the types and magnitudes of these differences in prediction and (2) the manner in which these differences are effected by dropping selected yield observations.

A square root function, quadratic function, a "3/2" function and a Cobb-Douglas function were fitted to corn yields from an experiment in which nitrogen and P_2O_5 were the variable nutrients. Then, yield observations resulting from zero rates of the nutrients were omitted from the experimental data and the same four types of functions were fitted to the remaining yields. Predicted total yields, marginal yields, isoquants, isoclines, and economic optima for limited and unlimited capital situations were derived and compared for all eight functions.

The results of the analyses, which are subject to all the limitations of the experimental method, can be summarized as follows:

1. Before the observations were dropped, predicted

yield response to P_2O_5 was larger than response to nitrogen; the reverse was true after the observations were dropped. Hence, dropping the observations changed the relative response to the nutrients.

2. Differences were found to exist among the optimum nutrient combinations predicted by the functions. These differences were not removed by dropping yield observations. As would be expected when least squares procedures are used, predictions of functions within each group and between groups were most alike for nutrient combinations close to the experimental means.

3. Regarding the optimum nutrient combinations as the "upper limits" and the nutrient combinations for the low capital level of the limited capital solution as the "lower limits" of the economic recommendations, the effect of omitting observations below the lower limits was to make predictions between these limits and the mean levels more comparable. Contrariwise, predictions of nutrient inputs above the mean levels (profit maximizing combinations) were not much more alike after the observations were omitted than before they were omitted. 159 pages. $2.10.

ROLE EXPECTATION OF THE COUNTY AGRICULTURAL EXECUTIVE COMMITTEEMAN IN THE NEW YORK STATE EXTENSION SERVICE

(L. C. Card No. Mic 58-2440)

John Morris Fenley, Ph.D.
Cornell University, 1958

One of the major areas of cooperative extension administration and supervision needing intensive research, is the determination of the role played by the county extension committee. This thesis studies the problem through an analysis of the role expectation held by the committeeman on whom local extension responsibility is placed.

Objectives

There are five objectives of the study. First, to characterize the New York State agricultural executive committeeman. Second, to determine his role expectancy in the administrative and programing phases of his role. Third, to determine his role expectancy with respect to the following levels of committee relationship: Within-committee, committee-State Office, committee-county agricultural agent, and committee-people. Fourth, to determine his role contentment. Fifth, to identify significant relationships, if any, between role expectancy and such personal variables as age, education, type of farm, size of farm, land ownership, years of farming, years on committee, and member-status on the committee.

Procedure

A questionnaire was constructed by the author, pretested and revised, and mailed to 449 agricultural executive committeemen in 54 New York counties. Four hundred and fifteen questionnaires, 92.4 per cent of those sent out, were completed and returned by the committeemen. A high degree of validity and reliability of the data were shown to exist by appropriate tests. Data relating to each of the five objectives were analyzed and reported.

Conclusions

Broadly speaking, the agricultural executive committeeman's role concept includes budgeting and administrative responsibility. In his mind, the committee exists for the coordination, financing, and execution of his county's agricultural program. He looks to his fellow committeemen for harmonious action and interaction. He looks to the people of his county for general support through paid membership and participation in the agricultural program.

The committeeman recognizes his county agricultural agent as the key to successful operation of the county agricultural department. On the one hand, the committeeman expects to participate in hiring and evaluating the agent, as well as to participate in supervising his professional work and criticising his shortcomings. On the other hand, he looks to the agent as an educator, not only to train the committee, but through his teaching ability and his technical knowledge, to carry primary responsibility for the program of the county agricultural department. The committeeman expects from the State Extension Service a supply of well-trained agents to meet county committee needs.

The committeeman is proud to serve on the committee, gets real satisfaction from the intangible rewards of service above self. He is content to give freely, without thought of monetary return, his time and energy for the betterment of agriculture in his county and state.

Despite his high morale and high expectation of accomplishment and fulfillment of committee obligation, the committeeman recognizes certain areas in which he thinks improvement can be made. He and his fellow committeemen offer 164 suggestions for improving overall committee operation.

Relationship between personal variables and role expectancy were tested by the Chi Square technique. The minimum degree of relationship accepted was the five per cent level of significance. Significant relationship was evident in six of the eight variables examined. These were, age, education, size of farm, type of farm, years of farming, and member-status on the committee. Significant relationship was not evident in the other two variables tested, namely, land ownership and years on the committee.

Finally, the total view of the agricultural executive committeeman in 54 New York counties indicates that his role expectation includes a quite clear concept of his committee responsibility, and that he is making a conscientious effort to meet that responsibility.

228 pages. $2.85.

THE ECONOMICS OF FERTILIZER USE AND OTHER INPUT-OUTPUT DATA IN CORN PRODUCTION ON THE PUTNAM SOILS OF MISSOURI

(L. C. Card No. Mic 58-2356)

Stanley Wayne Spangler, Ph.D.
University of Missouri, 1958

Supervisor: Dr. Frank Miller

This study is based on 3 years of records from 92 farmers in Monroe County, Missouri. The land where the

records were obtained was level to rolling and average for the state in productivity. The principal crops grown in the area were corn, soybeans, and wheat.

The objectives of the study were:

1. To determine the economic effects of using fertilizer to grow corn.
2. To measure the residual effects of fertilizer on crops that followed corn.
3. To determine the influence of plant population on corn yields.
4. To measure the influence of planting dates on corn yields.
5. To measure labor and machinery costs in the production and harvesting of corn.

Acreage and yield records were obtained for the crop years 1953, 1954 and 1955, all of which were below average in rainfall. Extreme drouth in 1954 eliminated crop response to fertilizer.

In 1953 and 1955, phosphate and potash gave no significant yield increases. These two years showed 40 pounds of nitrogen to be profitable with corn selling for $1.00 per bushel and nitrogen costing 13 cents a pound. Fifty pounds would not have been profitable under these conditions.

Results obtained by the University of Missouri Soils Department show that the intensive margin of nitrogen use is reached at 130 pounds when corn is worth $1.00 a bushel and fertilizer costs 13 cents a pound. When these experimental data were adjusted to field conditions, 90 pounds of nitrogen were found to be profitable. When 1953 and 1955 yields in Monroe County were adjusted to average weather conditions, applications up to 65 pounds of nitrogen were found to be profitable.

The carryover effect of fertilizer raised soybean yields 2.06 bushels per acre for each 100 pounds of plant nutrients (N.P.K.) applied to the previous corn crop. At $2.00 a bushel this increase will pay 40 percent of the cost of 12-12-12 fertilizer for the corn when the price of fertilizer is $75 a ton. The response when wheat followed corn was 5.85 bushels per 100 pounds of nitrogen. At $1.70 a bushel this increase will pay 74 percent of the fertilizer cost when ammonium nitrate is worth $90 a ton.

The exact point of intensive margin in using fertilizer on corn is difficult to determine because of variable weather and prices. However, exactness is not important for farm operators who have soils that do not erode or leach. If expenditures go beyond the margin in a particular year, a considerable part of the cost can be recovered through increased yields of subsequent crops.

Rates of planting had very little effect on corn yields in 1953, 1954 and 1955. Average yields varied only .7 bushels per acre for stands under 10,000; 10,000 to 14,000 and over 14,000. In years of optimum rainfall thicker stands have given highest yields.

Analysis of weather conditions at critical growth periods shows that planting corn between May first and fifteenth normally will bring the crop to the critical growth stage when the chances of drouth are least.

The average machinery and labor cost of growing an acre of corn to maturity was $15.20. However, costs varied widely with the type and size of equipment used.

Harvesting costs varied from $5.57 where two-row pickers were used to $8.84 per acre where the work was done by hand.

The average cost of harvesting and storing silage was $16.68 per acre. The cost of binding fodder with a machine and shocking it by hand was $9.19 per acre.

151 pages. $2.00.

AN INDEX FOR SELECTING HOGS USING DATA FROM A TESTING STATION

(L. C. Card No. Mic 58-2202)

Thomas McNee Sutherland, Ph.D.
Iowa State College, 1958

Supervisor: Dr. Jay L. Lush

The results from the first three seasons of operation of the testing station, located near Ames, of the Iowa Swine Testing Association were studied. In the first two seasons each entry was four boars and two barrows from three litters by the same sire. In the third season each entry was three boars and a barrow from three litters by the same sire. The traits studied were: Daily gain, efficiency of feed conversion, backfat probe and, for the barrows only, percent lean cuts. Data were available on 672 boars and 265 barrows.

No trend was apparent in gain or efficiency, but season and breed differences were marked. Backfat probe decreased and percent lean cuts of the barrows increased over seasons. The Yorkshire and Landace breeds probed leanest but the Hampshire and Poland China gave the highest percentages of lean cuts. Differences between entries (i.e. between sires) were highly significant statistically and gave rather large estimates of the sire components of variance relative to the intra-litter component. In the data concerning farms with entries in more than one season, the differences between farms were surprisingly small.

Intrabreed heritability estimates, based on sib resemblances, were: Gain, .85, .52, .19; probe, 1.26, 1.20, 1.14; lean cuts percent, .33; and efficiency, .87, .75. To get the last the intra-pen phenotypic correlations were assumed to be .2 and .1 respectively.

Phenotypic correlations were small but indicated that faster gaining boars were generally fatter and more efficient. However the more efficient boars tended to probe leaner. Fast gain was positively correlated genetically with fatness and efficiency, but fat pigs tended to be less efficient genetically. Some of the genes making for high percentages of lean cuts also made for slow gains, while most of them made for efficient feed conversion and low backfat probes.

Economic weights calculated were: X_1, a pound of daily gain, $2.00; X_2, efficiency, a pound of feed per pound gain, $-6.00; X_3, an inch in backfat probe, $-4.50; X_4, one percent of lean cuts, $0.35. Probe has value only as an indicator of lean cuts. The aggregate genotype was then defined as

$$H = 2.00\ G_{X_1} - 6.00\ G_{X_2} + 0.00\ G_{X_3} + 0.35\ G_{X_4}.$$

The index presently used for comparing the performance of boars was set somewhat arbitrarily as $I_0 = 35\ X_1 - 40\ X_2 - 75\ X_3$. The indexes which would maximize R_{HI_i} were:

$$I_1 = 2.90\ X_1 - 7.71\ X_2 - 3.63\ X_3$$

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

$I_2 = 2.77 X_1 - 8.17 X_2 - 3.85 X_3 - .07 X_4$

$I_3 = 4.47 X_1 - 5.48 X_3$

with multiple correlations $R_{HI_1} = .900$, $R_{HI_2} = .904$, $R_{HI_3} = .737$. The relative improvements in H expected from a selection differential of one standard deviation in the index were:

$I_1 = 1.376$, $I_2 = 1.382$ and $I_3 = 1.127$. The corresponding figures for I_0 were $R_{HI_0} = .817$ and $\Delta H = 1.249$.

118 pages. $2.00.

AGRICULTURE, ANIMAL CULTURE

A PROCESS FOR MANUFACTURING A HIGH NITROGEN FEED SUPPLEMENT FROM WHEY

(L. C. Card No. Mic 58-2251)

David R. L. Arnott, Ph.D.
The Pennsylvania State University, 1958

Although cheese whey has been used for feeding of livestock its use has been limited by the low protein content of the whey in relation to the other constituents. A method of increasing the total nitrogen of cheese whey from a level of approximately 0.15 per cent to a level of approximately 0.80 per cent has been devised. The method involves the fermentation of cheese whey with Lactobacillus bulgaricus followed by subsequent treatment of the whey with anhydrous ammonia to neutralize the lactic acid formed during fermentation. Both intermittent and continuous systems of ammoniation are described. The continuous system utilizes a Beckman industrial pH meter, a Foxboro pH recording controller, and an air driven motor valve. This continuous system was set to meter the anhydrous ammonia into the whey to maintain a pH level of approximately 5.0. Total fermentation periods varied from a minimum of 48 hours with the intermittent ammoniation to a minimum of 12 hours with the continuous system. Both intermittent and continuous systems were operated with a 10 per cent level of culture addition at 110° F. and in both systems the lactose content of the whey was reduced to below one per cent. The amount of ammonia used to increase the nitrogen content of the whey is noted with the cost of ammonia calculated at approximately 35.3 cents per 100 gallons of whey.

The reaction involved in ammoniation is discussed with the viewpoint that the end product is ammonium lactate. Evidence is presented to show that there is a relationship between the lactose decrease and nitrogen increase during fermentation and ammoniation.

The approximate composition of five different batches of concentrated ammoniated whey is presented. Concentration levels varied from 43.59 per cent total solids to 89.30 per cent total solids. Ammonia loss during concentration and during storage at room temperature is noted as being insignificant.

The results of the experimental work show that the treatment of fermented cheese whey with anhydrous ammonia is a commercially feasible process for producing a high nitrogen whey product and it is suggested that further work be carried out on utilization of the product as a feedstuff for ruminant animals and perhaps as a source of nitrogen for use as a fertilizer. 67 pages. $2.00.

STUDIES OF A GENETIC INFLUENCE ON SERUM CHOLESTEROL AND ITS RELATIONSHIP TO SEVERAL ECONOMIC CHARACTERS IN CHICKENS

(L. C. Card No. Mic 58-2208)

Frank Llewellyn Cherms, Jr., Ph.D.
University of Maryland, 1958

Supervisor: Professor Frank H. Wilcox, Jr.

Two general approaches have been followed in a study of serum cholesterol levels in chickens. First, an attempt has been made to determine if there is a hereditary influence on serum cholesterol levels, and second, the relationship of this trait to several traits of economic importance has been studied. The influence of heredity has been studied by the determination of a heritability estimate, by an analysis for differences between sire and dam families, and by the development of lines possessing high and low levels of this trait.

Significant dam family differences were found for immature birds of the 1956 and 1957 random-bred populations, and also in the first generation female progeny of the high and low lines. The differences between dam families for serum cholesterol were not significant. A heritability estimate of .300 was obtained for the serum cholesterol levels of random-bred White Leghorns at 9 weeks of age. After one generation of selection on stock from the random-bred population, the difference between lines was not statistically significant; however, the high line did have the higher average level. From these results it has been concluded that there is a genetic influence on serum cholesterol in immature birds, but there also is an influence of environment.

Evidence suggestive of variation due to year was found in both New Hampshires and White Leghorns. However, further information is needed before such an effect can be determined. A definite effect due to sex was found in both immature and mature birds. At 9 weeks of age the males of the 1956 random-breds were found to have a level of 147 mg. per cent, and females had a level of 138 mg. per cent. However, at 28 weeks of age the males had a level of 158 mg. per cent, while the females had a level of 241 mg. per cent. No explanation can be given as to why immature males possess the higher level; but at maturity, it is possible that the high level in females is due to the presence of estrogen. No significant difference was found between weekly serum cholesterol levels from 1 to 10 weeks of age. At hatching time, however, the level was about three times that found at 1 week of age. These results suggest that serum cholesterol levels are comparable during the growing period.

The relationships between serum cholesterol at 9 and 28 weeks of age, and between cholesterol at these two ages and egg weight, shell thickness, albumen height, Haugh units, intensity of production, body weight at 11 weeks of age, and yolk cholesterol were determined by correlation coefficient. A significant but low negative

correlation was found between serum cholesterol at 9 weeks of age and body weight in females at 11 weeks of age, but in three other instances no such a relationship could be found. The same type of relationship was found between serum cholesterol at 28 weeks of age and albumen height and Haugh units measured at 32 weeks of age. Significant low positive correlations were found between serum cholesterol at 28 weeks of age and shell thickness and egg weight measured at 52 weeks of age. These results are quite inconclusive and additional information is needed on these relationships before any conclusions can be reached. 86 pages. $2.00.

THE RELATION BETWEEN WEIGHT AND PRODUCTION IN DAIRY CATTLE

(L. C. Card No. Mic 58-2380)

Barton Roby Farthing, Ph.D.
North Carolina State College, 1958

Supervisor: Dr. James Edward Legates

This study was initiated to determine the relative influence of live weight and age on production in Holstein and Jersey cows, and to develop a method of utilizing live weight as an aid to selection. These data indicated that age is more effective than weight in accounting for variation in production. In the Jersey data there was no relationship between mature equivalent (M.E.) production and live weight. In the Holstein data increases of 390 lb. in M. E. milk and 16 lb. in M. E. fat were associated with an average increase of 100 lb. in live weight. Estimates of the heritability of M. E. production in Holsteins were increased when production was corrected for weight. The greatest expected genetic improvement in M. E. milk was obtained when weight corrected M. E. milk was used as the basis for selection. 69 pages. $2.00.

SEXUAL PERFORMANCE IN DAIRY BULLS AS RELATED TO FREQUENCY OF EJACULATION

(L. C. Card No. Mic 58-2148)

Edward Charles Frederick, Ph.D.
University of Minnesota, 1958

Three experimental approaches were used to study the problem of sexual performance in dairy bulls as related to frequency of ejaculation. In the first experimental approach six bulls were given six weeks sexual rest and then depleted by collecting a successive number of ejaculates until three consecutive ejaculates were under 500 million spermatozoa per ejaculate. Subsequent depletions were made at 2, 4, 7 and 13 days after the initial depletion.

The quantity and quality of the semen of successive ejaculates were determined and an attempt was made to establish the spermatogenic capacity of the bulls. Four bulls were slaughtered at varying lengths of time after depletion and the spermatozoa remaining in the reproductive tract were determined.

In the second experimental approach, three sets of identical twin Holstein bulls were used in an incomplete block designed experiment to study the effects of two ejaculates every 2, 4, and 7 days on growth, development, sexual interest, semen quantity and quality.

A field trial was the third experimental approach used. One pair of 5-year-old and one pair of 10-year-old bulls were selected in each of five breeding associations in Minnesota and Wisconsin. One member of each pair was placed on four ejaculates per week, while the other member remained at two ejaculates per week. The effects of increasing the frequency of ejaculation were noted on sexual interest, semen production and quality. Fertility results were obtained on this experiment.

Under the conditions of these experiments, the following conclusions were made:

1. With the collection of successive ejaculates, semen volume, spermatozoa number and spermatozoa concentration decreased; raw and dilute motility and percent of abnormal spermatozoa were not markedly affected; while pH gradually increased.

2. Depletion at intervals of 2, 4, 7 and 13 days after an initial depletion (1) caused no decrease in the number of normal spermatozoa nor an increase in the number of spermatozoa showing protoplasmic droplets; (2) average spermatozoa concentration, raw and dilute motility, and pH were restored to the pre-depletion level by 7 days after depletion; (3) average volume per ejaculate and per depletion were not restored to the pre-depletion level until 13 days after depletion.

3. The daily rate of spermatozoa production in the bulls used in the depletion study was 1.938 billion. Each gram of testicular tissue produced 1,639,593 spermatozoa daily.

4. In the identical twin experiment, the bulls on the higher frequencies of ejaculation as compared to the lower frequencies of collection (1) showed no difference in growth and development; (2) had a lower sexual interest as indicated by a longer preliminary time and reaction time, lower excitement score, thrust score and percentage of successful mounts; however, the differences were not statistically significant; (3) had a decreased volume of semen per ejaculate (not significant), however a significant increase in the volume of semen per unit time; (4) had a significant decrease in the number of spermatozoa per ejaculate but an increase in the spermatozoa produced per unit time; (5) did not differ significantly in spermatozoa concentration of the semen; (6) did not differ significantly in quality of semen as judged by raw and dilute motility, percentage of abnormal spermatozoa and percentage of live spermatozoa; (7) had a significantly longer reaction time as indicated by an extended methylene blue reduction time and (8) had a slightly higher (significant) semen pH.

5. Increasing the collection frequency of bulls used routinely in artificial breeding from two to four ejaculates per week resulted in an 88 percent increase in semen production without affecting fertility.

215 pages. $2.80.

METABOLISM OF GLYCEROL BY FROZEN AND UNFROZEN BOVINE SPERMATOZOA

(L. C. Card No. Mic 58-2252)

Wayne Talmage O'Dell, Ph.D.
The Pennsylvania State University, 1958

The importance of glycerol as a constituent of diluents for both frozen and unfrozen bovine semen and the paucity of information on factors affecting glycerol metabolism by bull spermatozoa instigated the present study.

A series of laboratory experiments were conducted to determine: (a) the effect of freezing on the metabolic activity of bovine spermatozoa both during and after storage at -79° C., (b) the effect of sugars and various semen diluents on glycerol-1-C^{14} uptake and utilization by bovine spermatozoa, and (c) the effect of adding glycerol to skimmilk and egg yolk-citrate diluents on lactic acid production by unfrozen and frozen, thawed spermatozoa.

Metabolic activity was determined by measurements of (a) $C^{14}O_2$ production from 5 to 10 microcuries of glycerol-1-C^{14} or glucose-U-C^{14} and (b) sugar utilization and lactic acid production by spermatozoa during incubation for 3 hours at 37° C. Spermatozoa also were assayed for uptake of glycerol-1-C^{14}.

No evidence of respiratory activity by bull spermatozoa in skimmilk-glycerol diluent during storage for 6 months at -79° C. could be demonstrated as measured by production of $C^{14}O_2$ from radioactive substrates present in the frozen medium.

Freezing resulted in harmful effects on post-thawing metabolic activity of spermatozoa. After 6 months at -79° C., twice-washed spermatozoa showed 34% less $C^{14}O_2$ production from glucose-U-C^{14} during post-thawing incubation than during a similar pre-freezing incubation period. Unwashed spermatozoa frozen and stored for 1 hour produced 61% less lactic acid after thawing than spermatozoa from the same semen samples which were not frozen. The 36% loss of motile spermatozoa due to freezing was not sufficient to explain the greatly reduced post-thawing lactic acid production.

Spermatozoa stored frozen for 1 hour in skimmilk-glycerol showed significantly greater post-thawing lactic acid production during incubation under air than those frozen in 1:4 egg yolk-citrate-glycerol, even though fewer spermatozoa survived freezing in skimmilk. Adding 1.25% fructose to skimmilk-glycerol and egg yolk-glycerol diluents resulted in greater lactic acid production by both frozen and unfrozen spermatozoa. However, frozen samples still showed greatly depressed metabolic activity as compared to unfrozen samples.

Glycerol-1-C^{14} uptake and utilization by twice-washed spermatozoa were highly significantly less in skimmilk, homogenized milk, and 1:4 egg yolk-citrate diluents than in 0.9% saline diluent. Spermatozoa in milk diluents metabolized more glycerol than those in egg yolk-citrate. The presence of utilizable substances in milk and egg yolk appeared to be responsible for sparing glycerol utilization.

Adding fructose to a 0.9% saline diluent resulted in less ($P<0.01$) glycerol-1-C^{14} utilization by twice-washed spermatozoa than when fructose was omitted. Arabinose also exerted a slight sparing action on glycerol utilization. Significant quantities of fructose and arabinose disappeared during incubation. No lactic acid was produced from arabinose, while fructose utilization resulted in the accumulation of large amounts of lactic acid. Preferential utilization of fructose and arabinose apparently spared glycerol utilization.

Glycerol spared anaerobic glycolysis of bull spermatozoa. Less sugar was utilized by twice-washed spermatozoa during incubation under nitrogen when glycerol was added to saline, saline-fructose, and saline-arabinose diluents than when glycerol was omitted. Glycerol addition resulted in greater lactic acid accumulation in saline and saline-arabinose diluents. However, in saline-fructose diluent, less lactic acid was produced when glycerol was added.

A decrease ($P<0.01$) in lactic acid production by unwashed spermatozoa during incubation under air in skimmilk and egg yolk-citrate diluents was obtained when 10% glycerol by volume was added. There was no significant effect on sperm motility. Irrespective of glycerol addition, spermatozoa in egg yolk-citrate produced greater ($P<0.01$) amounts of lactic acid than those in skimmilk. Lactic acid accumulation in egg yolk-glycerol was approximately equal to that in skimmilk without glycerol. Although sugar utilization was not determined, reduced lactic acid production indicated that glycerol also spared aerobic glycolysis of spermatozoa in milk and egg yolk diluents. 147 pages. $2.00.

THE METABOLISM AND LOCALIZATION OF GLYCEROL BY BOVINE SPERMATOZOA

(L. C. Card No. Mic 58-2354)

Bill Wayne Pickett, Ph.D.
University of Missouri, 1958

Supervisor: Dr. C. P. Merilan

Data are presented on the effect of various concentrations of glycerol on the anaerobic metabolism of bovine spermatozoa, under varying conditions of gassing, plus or minus fructose, radioactive and non-radioactive glycerol, in both calcium-free Krebs-Ringer bicarbonate and Krebs-Ringer phosphate buffers.

Autoradiographic studies have been conducted in an attempt to determine localization of glycerol-1-C^{14} in the bovine sperm cell. In view of the results obtained, an attempt was made to correlate the results with other known facts about the cell.

A detailed discussion of the various autoradiographic techniques and types of emulsion used in this study is also presented.

Glycerol in concentrations ranging from one to ten per cent inhibit the anaerobic metabolism of bovine spermatozoa, in which approximately two-thirds of the seminal plasma has been replaced with calcium-free KRC or KRP. Inhibition was greater in flasks containing the highest concentration of glycerol. Addition of 1.0 per cent fructose to 1.0, 3.3, or 10.0 per cent glycerol caused a marked stimulation of gas production during 105 minutes incubation at 38°C.

Glycerol plus fructose maintained a greater degree of motility and livability of bovine spermatozoa at the end of 105 minutes incubation than did either fructose or glycerol alone. One per cent glycerol plus one per cent fructose

was more beneficial to spermatozoan motility and livability than any of the other combinations tested.

Bovine spermatozoa under a pure nitrogen gas phase produced more acid when fructose was present with 1.0 and 3.3 per cent glycerol than with glycerol or fructose alone. Under similar conditions, more radioactive carbon dioxide was produced from 1.0 and 3.3 per cent glycerol-1-C^{14} than when fructose was present in the substrate.

Under the conditions of the autoradiographic studies, embedding the cells in liquid emulsions gave better results than liquid emulsions painted over the cells. However, either of these techniques was superior to the use of stripping film or dental X-ray plates for studying glycerol-1-C^{14} localization in the bovine sperm cell. In these studies it was found that glycerol-1-C^{14} apparently enters bovine spermatozoa and the greatest amount appears to accumulate in the nuclear area followed by the mid-piece and tail, in that order. 102 pages. $2.00.

THE INTERACTION BETWEEN ENVIRONMENT AND HEREDITY AS MEASURED BY FEED LOT PERFORMANCE AND CARCASS CHARACTERISTICS IN SWINE

(L. C. Card No. Mic 58-2160)

August Benhart Salmela, Ph.D.
University of Minnesota, 1958

Heredity and environment interactions were studied in regard to feedlot performance and carcass characteristics of 179 crossbred pigs which were sired by the Minnesota No. 2, Minnesota No. 3 and Minnesota No. 2A boars and out of Minnesota No. 1 dams. The pigs were fed out in pens of 10 pigs each with each breeding replicated twice for each of the three feeding treatments. The treatments were full-feeding, 85 percent restricted-feeding, and the self-feeding of a mixture containing 20 percent grass and alfalfa meal and 80 percent concentrates.

In addition to the heredity and environment interaction study, the last rib probe (of carcass) method was compared with the area of the loin eye at the 10th rib for predicting the yield of five primal cuts.

The Minnesota No. 2A x Minnesota No. 1 pigs had the longest carcass, were heaviest in ham and picnic weights, had the largest area of loin eye at the 10th rib, and the highest yield of lean as estimated by the last rib probe. The 2A x 1's were also the most efficient in feed utilization, had the thinnest average back fat and the least total fat as estimated by the last rib probe.

The Minnesota No. 3 x Minnesota No. 1 showed the thickest back fat, had the lowest percent of lean, the smallest area of loin eye at 10th rib, and were the lowest in yield of five primal cuts.

The Minnesota No. 2 x Minnesota No. 1 breeding excelled the other two crosses in cold carcass and loin weights. This cross was higher for area of loin eye at 10th rib and percentage of lean than the 3 x 1 crossbreds. They also required less feed per 100 pounds gain, had a lower average back fat thickness and lower percentage of fat in the carcass. Weights of the loins and hams and the loin eye area characteristics were not affected by feeding treatments.

Full fed pigs exceeded those in the other two treatments in average daily gains, feed per 100 pounds gain, live weight before slaughter, cold carcass weight, average back fat thickness, total weight of five primal cuts, weight of bellies, and in percentage of fat in the carcass. The fullfed pigs reached 200 lbs. at a younger age and yielded the lowest proportion of lean meat.

The pigs restricted to 85 per cent of full feeding had the heaviest picnics and Boston butts and were the oldest at 200 pounds live weight. There were no significant differences between the pigs on 85 per cent restricted and the 80-20 rations in feed efficiency, average back fat thickness, cold carcass weights, live weight before slaughter, total weight of five primal cuts, weight of bellies and fat and lean in the carcass.

Significant breeding x treatment interactions were found in age at 200 pounds live weight, average daily gains, length of carcass, ham weights and the 10th rib loin eye area. The 3 x 1 crosses had the largest area of loin eye when fed the 80-20 ration while the 2 x 1 crosses produced loins of the smallest area with this treatment. The 2 x 1's had their greatest loin-eye measurements under full-feeding but with this treatment the 3 x 1 cross developed its smallest loin eye areas. The 2A x 1 pigs had the largest loin eye areas and they developed their loin eyes equally well under full feeding as with the 80-20 ration.

No significant differences were found in comparing the last rib probe (of carcass) method and the 10th rib loin eye areas for predicting the yield of five primal cuts. 99 pages. $2.00.

THE EFFECT OF THREE LEVELS OF GRAIN FEEDING DURING THE DRY PERIOD ON THE INCIDENCE OF KETOSIS, SEVERITY OF UDDER EDEMA, AND SUBSEQUENT MILK PRODUCTION OF DAIRY COWS

(L. C. Card No. Mic 58-2449)

Glen Henry Schmidt, Ph.D.
Cornell University, 1958

Sixty-three dairy cows of four breeds from the Cornell University Dairy Herd were used over a two-year experimental period. The cows were assigned to trios according to breed and previous production. All cows received 2 lbs. of corn silage per 100 lb. body weight daily and hay ad libitum starting eight weeks before the expected calving date. One member of each trio, selected at random, received no grain during the dry period. A second member received 6 lbs. of grain daily and the third member received 15 lbs. daily. After calving all cows were treated the same. Three lbs. of corn silage per 100 lbs. body weight were fed daily in addition to the ad libitum feeding of hay. Each cow received 10 lbs. of grain on the day after calving and the amount of grain fed was increased 1 lb. daily until she received the amount of grain warranted by her production. Visual body condition ratings were made by three persons at the start of the experiment, one week before calving and 12 weeks after calving. Udder edema measurements by palpation were made by the same three persons on the day of calving and seven days after calving.

The cows receiving 15 lbs. of grain daily during the dry period consumed less hay during the dry period and the first 28 days of production. The cows were also heavier at the start of the experiment. The weight gains during the dry period averaged 41.60, and 98 lbs. for the zero, medium, and high levels of grain respectively. The weight losses for the first 84 days of production for the three groups were 52, 72, and 144 lbs., respectively.

The cows on the high level of grain during the dry period had higher body condition ratings at the start of the experiment, gained slightly in body condition during the dry period, and lost considerably more condition during the first 84 days of production than the cows on the zero and medium levels of grain.

The average milk production, butterfat production and 4% fat corrected milk for the zero, medium, and high groups were 4980, 4802, 5106; 219, 226, 227; and 5271, 5304, and 5444 lbs., respectively. None of these differences were statistically significant at the 10% level of probability. Correlation coefficients between body condition ratings at calving and 4% fat corrected milk, milk production, and butterfat percentage were all very small and non-significant.

No statistical differences in the severity of udder edema in the three groups were noted at calving or at seven days after calving. The high group had slightly more edema. A comparison of eight cows used both years but receiving different levels of grain showed that most of the cows had about the same severity of edema regardless of the level of dry period feeding. Udder edema was significantly correlated with 4% fat corrected milk production, but not with body condition at the time of parturition.

Two cases of ketosis occurred in the medium and high groups and one case occurred in the zero level. No marked differences were seen in the incidence of mastitis, retained placenta, metritis, cystic ovaries, or milk fever. Blood sugar and ketone levels were about the same in all the experimental groups. High blood sugar values were obtained on the day of calving and reached a low two to three weeks after calving. Blood ketones reached a high on the third week after calving and then gradually decreased.

No differences in birth weights of the normal Holstein calves between groups were obtained. The females in this experiment weighed about the same as the male calves.

93 pages. $2.00.

AGRICULTURE, FORESTRY AND WILDLIFE

AN INVESTIGATION OF THE EFFECT OF SOME PRODUCTION TECHNIQUES AND WEATHER FACTORS ON MAPLE SAP AND SUGAR YIELDS IN A CENTRAL MICHIGAN WOODLOT

(L. C. Card No. Mic 58-2321)

Bingham Mercur Cool, Ph.D.
Michigan State University, 1957

Major Professor: T. D. Stevens

A study of some of the aspects of maple sap production was undertaken at Michigan State University. The experimental area was approximately six acres of a sixty-eight acre woodlot on the campus. A total of 168 buckets was hung on 120 trees each year for four years. Daily sap weights and sugar per cent (total Brix) were recorded for each taphole. Sap and sugar yields were analyzed statistically for various treatments as follows:

Twelve trees had taps at one, two, and three feet. The one-foot tapholes were occasionally covered with snow and remained frozen, producing significantly lower yields. No significant differences were found between two- and three-foot taps.

Twenty-four trees were tested each year with random pairs of four spout designs. No significant differences in yield of sap or sugar were found.

Forty-eight one-bucket trees were used each year to test tapping depths of two, four, and six inches. Somewhat inadequate results have been interpreted as indicating that any gain from increased tapping depth over two inches would be too slight to offset the additional labor and damage to the trees.

Thirty-six one-bucket trees were used each year to test taphole diameters of three-eights, seven-sixteenths, eleven-sixteenths, and fifteen-sixteenths inches. Differences in yields due to taphole diameter were not statistically significant.

For some of the preceding experiments plastic bags were substituted for metal buckets to catch the sap. Each year the yields from those trees with bags and those with buckets showing no complicating features were analyzed for differences due to type of container. No significant differences were demonstrated. However, each year the yield from the plastic bags exceeded that from the buckets.

All of the experiments had tapholes randomized over the four cardinal compass quadrants. Any that showed no obvious bias due to other factors were combined to test differences in yields due to compass position. For one year of the four the taps in the north quadrant produced highly significantly less sap than the other three sides. The difference was not sufficient to justify avoiding the north side at the risk of concentrating taphole damage in the other quadrants.

Eighteen trees of approximately seventeen inches in diameter were included in these experiments--nine having two tapholes and the other nine only one. Similarly, sixteen trees were found that were approximately twenty-one inches in diameter, with eight having three buckets and eight having only two. The yields from these trees were analyzed for four years for differences due to additional tapholes in trees of a given size. The differences were not statistically significant.

Daily temperature and humidity data were gathered on the experimental area. These were supplemented by other weather observations obtained from the Weather Bureau. An attempt was made to relate these factors to daily sap flow and total yield. The relationship between maximum daily temperature and sap flow was very close. Examination of the rest of the weather data failed to disclose any significant trends of correlations. 140 pages. $2.00.

A PROPOSED TECHNIQUE FOR MEASURING AND COMPARING THE ECONOMIC IMPORTANCE OF TIMBER AND WILDLAND RECREATION IN MICHIGAN

(L. C. Card No. Mic 58-2430)

Marshall Nevin Palley, Ph.D.
Michigan State University, 1956

The important uses of wildland in Michigan are forestry and recreation. Demand for both timber products and recreational opportunities is on the increase. This enlarged demand for forest goods and services underlines the need for establishing priorities in forest land use, particularly in connection with the large area of publicly owned forest land.

One approach to setting up the needed priorities of use would be in terms of an economic comparison of forestry and forest recreation. The fact that the economic benefits resulting from each of these uses accrue not simply to the land owner but are widely diffused occupationally and geographically adds to the complexity of the problem of economic comparison. This study therefore has for its aim formulating a means of measuring and comparing the economic importance of timber and forest recreation in Michigan. Such a methods study is held to be a necessary preliminary to making the required economic comparison.

The problem under investigation has been approached through a critical review of related studies in the literature, a consideration and formulation of pertinent portions of economic theory, and an examination of the current availability of the desired statistical quantities.

Examination of a number of economic appraisals of the contributions of forest products and services indicated the wide range of approaches possible. A consideration of pertinent principles in the economics of land proved helpful in bringing the various services of forest land into sharper perspective. A brief survey of the wildland economy of Michigan served to emphasize the extent, uses, and relationships of the products of Michigan forest lands. Of the possible alternatives for measuring economic importance, the national income accounting approach of the U. S. Department of Commerce was the one selected as most serviceable for the purposes at hand.

The results of this study are of two kinds. An approach to measuring the economic importance of timber products and of the bundle of economic consequences of the use of land for recreation has been formulated in such a way that it will offer a fair comparison of these two alternative uses of forest land within the framework of the economy of the State of Michigan. This approach involves determining the contributions to the national income originating with each of these industries in Michigan. To achieve comparability, it has been proposed that the measurement be carried out at consumer level or at the highest level of production attained in Michigan and that measurement be limited to income accruing to the economy of Michigan.

Other results of this study relate to a test of the feasibility of the proposed measurement technique. Evidence is presented that the measurement for timber may be implemented with existing statistics on national income and the value added in manufacturing and trade. The state of information on the recreation industry is reviewed and the less complete and satisfactory portions of the needed information identified. The need for further consumer surveys to supply these deficiencies is indicated.

118 pages. $2.00.

ECOLOGY OF YOUNG GAME FISHES OF CLEAR LAKE, IOWA

(L. C. Card No. Mic 58-2199)

Richard Lewis Ridenhour, Ph.D.
Iowa State College, 1958

Supervisor: Dr. Kenneth Carlander

Young-of-the-year fish populations of Clear Lake, Iowa, have been sampled each summer since 1946. More intensive studies were conducted in 1956 and 1957 when samples were collected according to a Latin square schedule involving weeks, times of day, and 12 seining stations. Numbers and sizes of the fishes were recorded for each period. Growth and abundance of young yellow perch (Perca flavescens), walleye (Stizostedion vitreum), largemouth bass (Micropterus salmoides), bluegill and pumpkinseed (Lepomis macrochirus and L. gibbosus), black crappie (Pomoxis nigromaculatus), yellow bass (Roccus mississippiensis), white bass (R. chrysops), and black bullhead (Ictalurus melas) were studied. Young of five other game species were observed infrequently.

Young yellow perch, largemouth bass, bluegills and pumpkinseeds, black crappies, and black bullheads were usually found in heavily vegetated habitats, walleyes and white bass in moderately vegetated habitats, and yellow bass in sparsely vegetated habitats. All species fed primarily upon Entomostraca early in the summer but immature insects, Hyalella, and fish became increasingly important as the fish grew larger.

Observations and total catches indicated that year class success for most species was good in 1951, 1954, and 1956 while poor in 1949 and 1950. Growth by most species was good in 1952, 1953, and 1955 while poor in 1950. Available data indicated no relationship between environmental conditions and year class success or growth except that growth was usually better when aquatic vegetation was more abundant. The growth of young yellow perch, largemouth bass, bluegills and pumpkinseeds, yellow bass, and black bullheads was apparently slower when these species were abundant suggesting intraspecific competition while the growth of young largemouth bass, black crappies, and black bullheads was apparently affected by interspecific competition. Food was considered to be the primary limiting factor although other factors and particularly space limitations may have been involved.

The procedure for the evaluation of year class success was outlined following the analysis of variance of the Latin square model. Since all species were represented by zero catches in some hauls, the raw catch data required transformation by adding 0.5 and taking the square root of the sum. A pooled analysis of variance can be used to compare the catches between years. On the basis of the late August length frequency distributions approximately 100 measurements of each species were required each week to detect with 95 per cent confidence a 3 per cent difference from the mean.

The six weeks prior to August 31, the six two-hour periods from 6:00 PM to 6:00 AM, and six stations randomized according to the Latin square model were proposed as a future young-of-the-year sampling scheme for the collection of year class success and growth data. The week preceding the above schedule would be sampled only for growth studies and would be randomized independently.

122 pages. $2.00.

CREEL RETURNS OF CATCHABLE RAINBOW TROUT (SALMO GAIRDNERII) AND BROWN TROUT (SALMO TRUTTA) FROM AUGUSTA CREEK, KALAMAZOO COUNTY, MICHIGAN, 1952-1956

(L. C. Card No. Mic 58-2333)

Wells Eldon Williams, Ph.D.
Michigan State University, 1957

Analysis of data collected by the application of a mandatory creel count on a 2.4-mile section of Augusta Creek in southwestern Michigan over a five-year period revealed the following information. Fishermen spent more than 20,700 hours angling, and caught 6,930 trout; 6,062 were planted rainbow trout, 479 planted brown trout, 384 brown trout assumed to be native to the stream or carried over from previous plantings, and one was a brook trout.

Nearly ninety percent of all trout creeled were taken by bait fishermen, seven percent by fly fishermen, and six percent by anglers using artificial plugs and spinners.

Of a total of 10,570 trout stocked in the stream section, 6,255 were taken in the year in which they were planted, and 267 were taken in subsequent years for an over-all return to the creel of 61.8 percent over the five-year period. This figure does not include trout caught outside the experimental stream section.

The average catch per angler dropped from 2.4 trout in 1952 to 1.3 trout in 1956. This decrease is attributed to the increase in angling pressure on the stream.

Approximately sixty percent of all angler visits to the stream resulted in zero catches. It seems apparent that the percentage of zero catches is a function of the number of hours fished, with the more "patient" anglers recording the largest catches.

Only 8.3 percent of the anglers accounted for more than fifty percent of the total number of trout caught during the five-year study period. The frequency distribution of various-sized catches can be represented by a curve similar to that of the Pareto distribution of special abilities as applied to incomes in a stable society or home runs in baseball. This implies that anglers' catches may be directly related to special abilities of fishermen, and that some individuals have an inherited or acquired ability to catch fish, while others are not so endowed.

The returns of planted trout from the Augusta Creek test stream indicate that the present stocking policy is adequately efficient, even though more than fifty percent of the anglers reported no trout to the creel. It is possible that a substantial percentage of planted trout are caught outside the experimental area, and that the returns reported should be considered minimum returns.

88 pages. $2.00.

AGRICULTURE, PLANT CULTURE

ESTABLISHMENT AND EARLY PLANT DEVELOPMENT OF BIRDSFOOT TREFOIL (LOTUS CORNICULATUS L.) AS AFFECTED BY SEVERAL FACTORS OF COMPETITION

(L. C. Card No. Mic 58-2253)

John Elmer Baylor, Ph.D.
The Pennsylvania State University, 1958

Difficulty in establishing satisfactory stands has limited the wider use of broadleaf birdsfoot trefoil in its main areas of adaptation. Much of this difficulty has been associated with its inherent lack of aggressiveness during the early stages of growth. A system of seeding and early seedling management to favor rapid establishment of trefoil is highly desirable. It would thus be better able to compete with its associated species for the various factors of growth. Such a system should, therefore, result in better stands of more vigorous trefoil plants.

Accordingly, field investigations were undertaken to isolate some of the effects of seed placement, plant nutrient placement and plant associations on the establishment and productivity of European birdsfoot trefoil. Mixtures studied included: birdsfoot trefoil alone; birdsfoot trefoil and common timothy; birdsfoot trefoil, timothy and Atlantic alfalfa; and birdsfoot trefoil and alfalfa. Seed of the birdsfoot trefoil component of each mixture and a 5-10-10 fertilizer were either banded in 7-inch rows or broadcast on the soil surface in all combinations.

Greenhouse experiments were initiated to study top and root development of Viking birdsfoot trefoil as affected by various populations of several associated species, including trefoil itself, at two dates after seeding. The effects of several associated grasses and legumes on the top and root development of Viking birdsfoot trefoil when grown in pots with roots associated and separated were also determined. Associated species included in the various greenhouse experiments were: birdsfoot trefoil, common orchardgrass, S-37 orchardgrass, Climax timothy, and Atlantic alfalfa. In an additional study the growth responses of several populations of Viking birdsfoot trefoil under three levels of light intensity (2630, 592 and 190 f. c.) were investigated.

Field Results

(1) Under conditions of medium soil fertility birdsfoot trefoil did not respond to band placement of fertilizer over broadcasting. Response was measured by stand counts, winter survival, and forage yield per acre.

(2) Banding birdsfoot trefoil seed resulted in significantly better initial stands over broadcast seeding but did not affect trefoil yields either when seeded alone or in mixtures.

(3) Trefoil stands were not affected the year of seeding by the presence in the mixture of either timothy or alfalfa. The competitive effect of alfalfa on trefoil stand was apparent, however, in the spring of the first harvest year.

(4) The stand and yield of trefoil was suppressed more severely by alfalfa in the August seeding than in the spring seeding.

(5) Weeds were a serious problem in both the spring and late summer seeding, especially when trefoil was seeded alone. When timothy was added to the mixture, it replaced weeds on nearly a pound for pound basis.

Greenhouse Results

(1) Birdsfoot trefoil was severely suppressed by common orchardgrass, S-37 orchardgrass, Climax timothy and Atlantic alfalfa as compared with a similar population of trefoil itself. Common orchardgrass was significantly more suppressing than S-37 or timothy which in turn were more competitive than alfalfa.

(2) Growth of trefoil was significantly greater where its roots were grown separately from those of both orchardgrass varieties, timothy and alfalfa. The growth response of trefoil when grown with additional trefoil was similar regardless of root relationship.

(3) Birdsfoot trefoil, timothy, and common orchardgrass, in order from least to most, caused a significant suppression in growth of a basic trefoil population both 90 and 130 days after seeding. Increasing the population of the associated species also significantly suppressed the basic trefoil population at both harvests.

(4) Top and root growth of birdsfoot trefoil were severely suppressed by reduced light intensities. Roots were affected more severely than tops.

(5) Both top weight and root diameter appear to be good indicators of birdsfoot trefoil root development.

119 pages. $2.00.

A STUDY OF ALFALFA RESPONSE TO APPLIED SULFUR AND THE SOIL AND PLANT SULFUR RELATIONSHIPS ON TWO GRAY WOODED SOILS IN NORTH WESTERN CANADA

(L. C. Card No. Mic 58-2254)

Robert Ross Cairns, Ph.D.
The Pennsylvania State University, 1958

The so-called Gray Wooded soils were first studied and described in Western Canada, where they occupy more than one hundred million acres of the forest region. Experimental work by the University of Alberta and the Canada Department of Agriculture on some of the Gray Wooded soils showed that small applications of sulfur (20 pounds per acre), gypsum, or any soluble sulfate salt resulted in increased crop yields. These findings led to the belief that Gray Wooded soils were characteristically deficient in sulfur. More recent work on the Loon River and Garrick Gray Wooded soils in Saskatchewan has revealed that the Loon River soil gives a marked response to sulfur, while the Garrick soil does not. Response is mainly evident in legume crops.

No criterion, other than field trials, has yet been developed to distinguish between a sulfur-responsive and a non-sulfur-responsive Gray Wooded soil. In an effort to establish such a criterion the sulfur-responsive Loon River loam and the non-responsive Garrick loam Gray Wooded soils were studied from the standpoints of the yield and chemical composition of alfalfa grown in the presence and absence of applied sulfur, nitrogen, phosphorus, potassium and a mixture of trace elements. Various chemical, biological and mineralogical soil characteristics and the effect of applied sulfur on various of the soil characteristics were also investigated.

Alfalfa grown on the untreated sulfur-responsive soil was low yielding and contained a lower per cent total sulfur and a very markedly lower per cent soluble sulfate than alfalfa grown on the non-responsive soil.

The alfalfa grown on the responsive soil increased in per cent nitrogen with the application of sulfur even though it contained a higher per cent when untreated than did the alfalfa grown on the non-responsive soil.

Sulfur treatments increased the total sulfur and the soluble sulfate content of the alfalfa on both soils. However, the soluble sulfate content was much more sensitive to changes in sulfur supply. There was a negligible quantity of sulfate in alfalfa grown on the untreated responsive soil, but sulfur treatments that increased yields raised the level of sulfate in the alfalfa to equal or exceed that in alfalfa grown on untreated areas of the non-responsive soil. The per cent organic sulfur in the alfalfa was found to decrease slightly with increased sulfur supply and increased sulfate content. This relationship may explain why the soluble sulfate fraction was a more sensitive index of the sulfur status of the crop than was the total sulfur content.

Both soils were found to contain relatively large quantities of barium, but the sulfur-responsive soil had larger quantities of readily soluble barium than the soil on which alfalfa did not respond to sulfur treatment. It was also found to be capable of precipitating a considerable quantity of sulfate in an acid medium. This precipitation was found to occur either within the soil or in an acid extract of the soil. It was found that the responsive soil did not release any appreciable quantity of soluble sulfate on incubation, while it did release a quantity of nitrate equivalent to that released by the non-responsive soil. It was also found that the responsive soil was either incapable of effectively oxidizing elemental sulfur in the field, or that the oxidized sulfur became unavailable to the crop through precipitation in an insoluble form. The evidence points to barium as a possible contributing factor in the sulfur deficiency of this soil.

The sulfur-deficient soil was found to contain markedly lower quantities of both total sulfur and acid soluble sulfate in the C horizon. It also contained a lower quantity of organic matter and exchangeable bases in the surface soil.

114 pages. $2.00

DEGRADATION OF SOILS AND MICACEOUS MINERALS BY THE REMOVAL OF POTASSIUM WITH SODIUM TETRAPHENYLBORON

(L. C. Card No. Mic 58-2187)

Ruppert Rudolph Hunziker, Ph.D.
Iowa State College, 1958

Supervisor: Dr. A. Duncan Scott

It has been proposed that, since K in solution prevents or retards the replacement of the so-called "non-exchangeable" K from micaceous minerals, precipitation of K from solution following its displacement by replacing

cation should favor the rapid release of this "non-exchangeable" K without causing undue destruction to the mineral structure. Sodium tetraphenylboron (NaTPB) should effect such a precipitation of K in a soil system, since potassium tetraphenylboron (KTPB) precipitation is quantitative under the conditions of pH, salt concentration, and temperature normally used in the displacement of K. Thus, a study of conditions for using NaTPB in the degradation of soils and micaceous minerals was initiated.

The precipitation of KTPB in minerals, the separation of KTPB from the minerals, and the determination of K in the recovered KTPB were investigated. Because of the presence of NaTPB decomposition products and other organic matter contaminants in KTPB recovered from a degradation system, it was necessary to separate the K from KTPB and determine the K directly, rather than attempt to obtain a quantitative recovery of pure KTPB. Dry ashing of KTPB at 400° C. or higher in platinum crucibles, wet ashing by aqua regia, or separation of K on a cation exchange resin effected release of K from KTPB. The aqua regia hydrolysis of KTPB was adopted for use in these studies.

Marked NaTPB decomposition resulted from the boiling or autoclaving of NaTPB solutions at pH 4.8 or from such heat treatment of high-salt NaTPB solutions at pH 7.0. In a NaOAc-NaTPB-vermiculite system, K was removed from the vermiculite more rapidly through refluxing than through heating at 70° C., as long as undecomposed NaTPB remained in the system.

Much larger amounts of K were removed in a degradation of vermiculite by NaTPB alone than in a degradation by salt at high concentration. High-salt NaTPB solutions effected greater K removal than did NaTPB solutions. Thus it was shown that the continued removal of displaced K from solution as KTPB resulted in the accelerated degradation of micaceous minerals.

In the degradation of the resistant mica, muscovite, with a NaTPB-salt solution, 10.9% of the total K was removed. Most of the K removal, 8.7% of the total K, occurred during a 60-day degradation at room temperature. In this experiment and in one with vermiculite the importance of time as a factor in the degradation of minerals was demonstrated.

Results obtained from the degradation of a Fayette and a Carrington soil by a NaOAc-HOAc-NaTPB system indicated that such a degradation may be useful in the determination of the K-supplying power of soils.

122 pages. $2.00.

INHERITANCE STUDIES, INCLUDING REACTION TO CERTAIN FOLIAGE DISEASES, IN ALFALFA

(L. C. Card No. Mic 58-2154)

Elmer Carl Johnson, Ph.D.
University of Minnesota, 1958

Adviser: W. M. Myers

Disease resistant and hardy varieties of alfalfa provide the logical solution to problems of foliage diseases and winter survival. The evaluation and determination of the breeding behavior of characters of winter survival ability and resistance to foliage diseases are major concerns of alfalfa breeders in their attempts to develop superior varieties. The data in this study indicate that field evaluation of alfalfa for reaction to specific pathogens under natural epiphytotics of disease is possible to an extent sufficient to permit breeding for resistance.

Eleven alfalfa clones, the single crosses (including reciprocals) among them, open-pollination progeny of 10 of the clones, and 9 commercial varieties were studied in the field for reaction to the prevalent leaf and stem diseases and for winter survival ability.

Differences were highly significant among clones, among single cross progenies, and among commercial varieties for reaction to common leaf spot (Pseudopeziza medicaginis). Parent-progeny correlations were highly significant, and high estimates of heritability were obtained. The mean of the progeny of certain crosses between resistant and susceptible parents was slightly nearer the mean of the resistant parent than the mean of the susceptible parent suggesting at least partial dominance of resistance.

Differences in reaction to Cercospora leaf spot (Cercospora Zebrina) were significant among clones and among single cross progenies but were not significant among commercial varieties or among open-pollination progenies. Parent-progeny correlations were highly significant, and heritability estimates were substantial.

Differences in reaction to Stemphylium leaf spot (Stemphylium botryosum and Pseudoplea trifolii) were significant among clones, among both progeny types, and among commercial varieties. Parent-progeny correlations were highly significant and heritability values were relatively high.

Resistance to stem blackening behaved as a highly heritable character when blackening was caused largely by Phoma herbarum var. medicaginis. When stem blackening was produced by several organisms acting at the same time, parent-progeny correlations dropped below significance level and heritability estimates were low. Leaf spot caused by Phoma behaved as a highly heritable character with highly significant parent-progeny correlations and relatively high estimates of heritability.

Differences in foliage yellowing caused by leafhoppers were significant among clones and among single cross progenies but were not significant among open-pollination progenies or among commercial varieties. Significant parent-progeny correlation and the estimates of heritability indicate breeding for resistance is practicable.

Per cent leaf loss as a character had highly significant parent-single cross correlation and substantial heritability estimates. The data show that factors other than foliage diseases are also important in loss of leaves. Differences in leaf loss were highly significant among clones and among single crosses but were not significant among commercial varieties or among open-pollination progenies.

Winter injury, fall dormancy and summer erectness of growth as characters showed close association, high heritability estimates and highly significant parent-progeny correlations. The most winter hardy plants tended to be the most dormant in the fall and least erect in summer, but not all fall-dormant plants were correspondingly winter hardy.

Significant correlation of characters in progeny populations was observed. These correlations appeared to result from the occurrence together of the particular characters in the parent clones. Since these correlations were

determined from progeny means, the relationship of characters in the parental clones would be expected to occur also in their first generation progenies. Correlation values were lower when computed from individual plant data than when computed from plot means of the same data.
102 pages. $2.00.

EFFECTS OF COMPETITION FROM COMPANION CROP AND FROM INTER-SPECIES ASSOCIATIONS ON FORAGE STAND ESTABLISHMENT AND YIELD

(L. C. Card No. Mic 58-2188)

Ralph Edward Krenzin, Ph.D.
Iowa State College, 1958

Supervisor: Iver J. Johnson

The role of the companion crop and methods of managing it are of major importance in successful establishment of forage crop seedings. An increased use of the companion oat crop for pasture, hay and silage directs even greater attention to the relationship between that crop and the establishment of forage crop stands. Frequent failures to establish good stands of birdsfoot trefoil indicate a more critical relationship between seedling growth of this species and the companion crop than for other forage species.

A field experiment was established in 1953 to study the relationships among variety, seeding rate and management of the oat companion crop to forage crop stands and yields. Three oat varieties, Cherokee (early), CI 3867 (midseason) and Shelby (late) seeded at 0, 1, 2 and 3 bushels per acre were removed at hay and mature stages of growth. Forage crops studied included associations of alfalfa-bromegrass and red clover-timothy.

Oat varieties used in the companion crop did not differ in effect upon legume stand or forage yield. Weed growth in the absence of the oat companion crop provided more competition to the forage seedings than the oat crop. Forage yields were significantly reduced when no companion oat crop was used. Legume stands and forage yields were greater as oat seeding rates were increased from 1 to 2 bushels per acre. Legume stands were higher and forage yields were increased when the oat companion crop was removed at hay stage of growth rather than at maturity.

A greenhouse experiment was conducted during 1956 and 1957 to study growth responses of alfalfa, birdsfoot trefoil and orchardgrass grown alone and each legume in 3 combinations with orchardgrass. Growth behavior patterns were measured in terms of accumulation of dry matter in successive 30 day periods.

Alfalfa plants made a greater growth in dry weight than birdsfoot trefoil during the period from 30 to 60 days and from 60 to 90 days after seeding, but birdsfoot trefoil produced a relatively greater growth than alfalfa from 90 to 120 days. Dry weight per plant for these two legumes were not greatly different after a period of 120 days of growth. Orchardgrass increased in dry weight more rapidly than either alfalfa or birdsfoot trefoil during the period from 30 to 60 days and from 60 to 90 days after seeding.

Orchardgrass grown in association with either alfalfa or birdsfoot trefoil suppressed yields of both legumes but was more competitive to birdsfoot trefoil than to alfalfa.

In these associations of alfalfa and birdsfoot trefoil with orchardgrass there was no evidence of either antagonistic or mutually beneficial effects as determined by gains or losses in plant weight of each component of the mixture.
46 pages. $2.00.

A STUDY OF THE VEGETATIVE GROWTH AND FLOWERING OF SNAPDRAGONS (ANTIRRHINUM MAJUS) AS AFFECTED BY THE INTERRELATIONSHIP OF LIGHT INTENSITY AND NIGHT TEMPERATURE

(L. C. Card No. Mic 58-2447)

Robert Ogden Miller, Jr., Ph.D.
Cornell University, 1958

The results of investigations with small snapdragon plants grown in nutrient solutions under artificial light and at various night temperatures indicate that optimum night temperature, in some cases, decreases with light intensity while in other cases more growth may take place at higher temperatures.

Plant size at the time of treatment may be important in determining the response of plants to night temperature. Evidence is presented suggesting a decrease in optimum night temperature with increasing plant size. In greenhouse experiments, exposure of snapdragon seedlings to temperatures of 60°F, 70°F, and 80°F for 2 or 4 weeks previous to benching resulted in plants that flowered earlier than those exposed to 50°F for 4 weeks previous to benching. Even though flowering was hastened, the final size of plants at harvest was not lowered by temperatures as high as 70°F for 4 weeks or 80°F for 2 weeks previous to benching.

Further work showed that adjusting night temperature upwards during the growing period after bright winter days resulted in earlier flowering, but was associated with a decrease in size as compared to plants being grown at normal temperatures. Under the conditions prevalent, however, this decrease in size was not serious. Reducing night temperatures after dark days throughout the growing period did not result in increased size or higher quality.
152 pages. $2.00.

FACTORS ASSOCIATED WITH LODGING RESISTANCE IN OATS

(L. C. Card No. Mic 58-2195)

Allan James Norden, Ph.D.
Iowa State College, 1958

Supervisor: Dr. Kenneth J. Frey

Seven oat varieties and three crosses were evaluated at Ames, Iowa in 1956 and 1957 for the association between lodging resistance (cL_r method) and culm diameter, culm wall thickness, area of cross section tissue, height, and yield. In addition standard unit heritability percentages were calculated for lodging resistance, and the changes in cL_r values between anthesis and maturity were studied in four varieties.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Of the three culm cross sectional measurements, large culm diameter and large area of tissue were the most closely associated with high lodging resistance, and genotypic correlations in the F_3 generation showed a sizeable common genetic association between lodging resistance and these two characters. A significant negative association between culm height and lodging resistance indicates selecting for shorter oat strains should produce greater lodging resistance. Lodging resistance in oats is a complex character which can not be explained completely on the basis of culm cross sectional measurements or height but must include other characteristics as well. Differences between varieties do not necessarily conform to established associations.

The most consistent correlations between cL_r readings and culm measurements were obtained when the measurements were taken one-half inch above ground level. Preserving collected culms in alcohol gave somewhat more consistent results than freezing them, but the latter method was more economical. Drying was completely unsatisfactory. The correlation between yield per panicle and lodging resistance was so low (r = .15**), that it should be of little importance in a plant breeding program. The changes in cL_r values from anthesis to maturity were uniform across varieties indicating that the lodging resistance could be compared at any time during this period providing the plant types and stages of maturity were similar.

Standard unit heritability percentages ranged from 9 to 22 percent showing that lodging resistance was strongly influenced by environmental variations. However, it should be possible to select segregates with greater lodging resistance than the parents entering an oat cross, since transgressive segregation was present in all three crosses. Possible methods for improving lodging resistance were suggested. One method would be to cross the most lodging resistant varieties and select for strains that transgress the parents in a positive direction. An alternative method would use mutation breeding to decrease the height of a tall strong variety while holding diameter constant.

56 pages. $2.00.

DEVELOPMENT, CROP MANAGEMENT AND HARVEST OF BIRDSFOOT TREFOIL (Lotus corniculatus L.) SEED

(L. C. Card No. Mic 58-2453)

John Earl Esworthy Winch, Ph.D.
Cornell University, 1958

Limited supply of seed, resulting from problems encountered in seed production, have curtailed the more general and widespread use of birdsfoot trefoil (Lotus corniculatus L.) as a forage legume in areas where it is adapted and ones in which it could contribute to the agricultural economy. Low seed production of this legume is due not only to low acre seed yields but also to the uncertainty of a seed crop and to difficulty experienced in seed harvest.

In view of the agricultural importance of the crop and the many factors limiting seed production and supply a project was set up in 1953 to study seed technology problems of this legume. Investigations were undertaken during 1953, 1954, 1955 and 1956. Pod and seed development, Management and harvest practices suited to use with Empire and Viking birdsfoot trefoil were studied.

Many inflorescences were found to develop on the indeterminate stems of this legume. Those from the first three flowering nodes developed seed of equal quality. Ninety-six percent of the harvested seed was produced at these first three nodes. Later developing inflorescences either abscissed or produced late maturing seed which was of low quality at harvest. Flower development occurred on a clonal line of Viking under 14, 14.5 and 16.5 hours but not under 9 or 11.5 hours of day length. Sixty-eight percent of the flower-buds abscissed under 14 hours and 26 percent under 16.5 hours of day length.

Seed pods changed in color with advancing maturity. Pod color was found to be a valuable index of seed maturity. Light green to white pods contained seed of equally low quality. Pods ranging from light buff through dark brown produced mature seed of high quality. The period of time required to produce mature seed varied depending upon the prevailing weather conditions. Moist, cool conditions during pod development delayed, and hot, dry periods hastened pod development and seed maturity.

A birdsfoot trefoil plant population of four plants to the square foot produced the highest seed yield to the acre. Wide row plantings (36 inches) were found to produce more seed during the second and succeeding crop years than broadcast or narrower row widths. The inclusion of tall growing grasses (bromegrass, tall fescue, orchard grass and timothy) in mixtures with birdsfoot trefoil lowered the seed yield by reducing the number of flowering and seed producing stems. Dalapon (2,-2, dichloropropionic acid) safely removed most grasses, it also controlled red and alsike clover in seed fields of birdsfoot trefoil. Four to five pounds of this chemical applied in the spring when the plants were in the early vegetative or dormant state caused no injury to birdsfoot trefoil. Clipping seed fields of Empire as late as the end of May did not reduce the seed yield but delayed the data of seed harvest by four days. Clipping in June or later reduced the seed yield and increased the delay in harvest of this variety.

Seed losses were extensive and excessive where the crop was cured in the windrow for more than 10 hours following mowing. Under favorable curing conditions the green forage was sufficiently cured for successful combine operation and harvest.

Two pints of the dessicant dinitro (4,-6 dinitro ortho secondary butyl phenol) to the acre promoted complete drying of Viking in a period of 50 hours. Seed losses as a result of pod shattering became increasingly large from 30 to 50 hours after application of the dessicant. The most successful time for direct combine harvest of the seed crop was between 24 and 30 hours after application of this dessicant. Direct combine harvest was possible at 24 hours. At this time seed loss was at a minimum yet the crop was sufficiently dry for threshing and seed separation.

The findings of this study indicate that a substantial increase in the harvested yield of birdsfoot trefoil seed is possible. To achieve this end an intimate knowledge of the anatomy, physiology and development of the plant and ecology of the area in which the crop is grown is essential. Successful seed production will depend upon the application of cultural, management and harvest practices based upon knowledge of the above facts.

124 pages. $2.00.

STUDIES ON THE LIFE HISTORY AND ECOLOGY OF CUTEREBRA SPP. OCCURRING IN MICHIGAN COTTONTAILS WITH SYSTEMATIC STUDIES ON CUTEREBRINE LARVAE FROM OTHER MAMMALS

(L. C. Card No. Mic 58-2415)

Rudolph Joseph Boisvenue, Ph.D.
Michigan State University, 1955

The purpose of this study was (1) to investigate the phases of the life history of Cuterebra sp. as they occur under natural conditions, (2) to elucidate the ecology of the cuterebrid flies in relation to vegetation, soil and host, the Michigan cottontail, Sylvilagus floridanus mearnsii, and (3) to clarify the systematics of cuterebrine larvae collected from certain mammals.

The life history and ecology of Cuterebra species, occurring in Michigan cottontails, were studied in part by means of a two-year live trapping program of rabbits. Field observations on adult cuterebrid flies and rabbits were also carried out. One hundred and seventy rabbits were captured and were screened for Cuterebra larval infections. Infected cottontails were brought into the laboratory and studied for phases of the life cycle.

Records on the duration of third stage larvae in the cottontails related an average of 15 days. Concurrent with the above study, it was found that the air hole diameters of larvae reflected the phases of the third stage larvae while in the host.

Mode of infection studies were done in the field using twenty-two penned cottontail and domestic rabbits in areas having high larval incidences. A positive larval infection was obtained in a penned cottontail which was not exposed to natural vegetation.

The primary site of Cuterebra larval infections in 187 southern Michigan infected cottontails was in the neck. Other anatomical areas recorded were the scrota, cheeks, back and shoulders.

Suggestion of larval migration was observed when two third stage larvae appeared on the right side of the neck of an isolated cottontail which was externally diagnosed negative in that area a week previously. A large tumor appeared first in the area followed by two larval air holes overlying the tumor. No evidences of extensive larval migration were found in sixty-two cottontails which were autopsied throughout the Cuterebra cycle.

The time recorded for the obvious appearance of third stage larvae in cottontails from a negative diagnosis was 22 days.

First, second and third stage larvae were discovered in the cottontails which gave seasonal periodicities in their hosts. The seasonal periodicity of third stage larvae was determined to be between August 1 to 20. First stage larvae were believed to have a seasonal periodicity a month previous to the third stage larvae in the early part of July.

Seasonal incidence of cuterebrid larvae in southern Michigan juvenile cottontails was determined to be between August 1 and 20. For adults, it was found to be between July 20 to 30. In general, the juvenile cottontails had a higher incidence of Cuterebra larvae than adult rabbits. Also the number of warbles per infected rabbit was found to be the greatest when there was a peak in the incidence of Cuterebra larvae among the cottontails.

Field notes on pupation showed that mature larvae which have recently dropped from their hosts were able to survive 9 to 13 days before pupating. Depths recorded on 27 burrowing larvae offered a range of 1 1/2 to 2 1/2 inches in sandy soils. Field pupation experiments revealed that no two-year cycle existed for the pupae. Also one generation a year was shown to exist in Michigan for Cuterebra, regardless of exposing the pupae to artificial or natural conditions prior to the emergence of the flies. Longevity of adult flies were observed in laboratory pupation jars to range from 1 to 5 days.

Higher numbers of Cuterebra infections were recorded in areas having sandy soils. Also these sandy areas showed greater numbers of rabbit burrows. This situation was believed conducive to good pupation and consequently, successful emergence of adult flies with excellent conditions for larval infections in the rabbit burrows.

Vegetative sites such as dense sumac bushes, willow swales and clover fields were associated with adult cuterebrid flies.

One hundred and twenty-seven cuterebrid larvae, collected from cottontails, cats, dogs, jack rabbits and white-footed mice, were comparatively studied and taxonomic differences were presented for each instar of individual Cuterebra species studied. The results obtained in the systematic study of larvae were compared with the findings of previous workers. Buttons, peculiar to posterior spiracles of some dipterous larvae, were seen in the cuterebrid examples investigated.

A key is presented which separates the various instars of the individual larval species determined in the systematic study. Species of Cuterebra determined in this study were buccata, fontinella, and horripilum. An unidentified species, found on Nevada jack-rabbits was described and its larval characteristics are presented for comparison with the known cuterebrid species. No pupa-adult fly series were obtained for the identification of the Nevada species. However, they were obtained for the three identified species.

Verification of the three Cuterebra species was accomplished by means of a puparium from which a known identified adult fly emerged. With the morphological characteristics of the puparium it was possible to retrogress to the third instar and subsequently to the first instar of that species.

Larval species found in Felis domestica were C. buccata and horripilum, with a preponderance of the latter species. Cuterebra buccata was recorded from Canis familiaris. Michigan cottontails had both cuterebrid species, with C. horripilum predominating. The only larval species obtained from the white-footed mouse of Michigan was C. fontinella.

A check-list of the Cuterebra species of the western hemisphere is presented with records of their geographic locations and the scientific names of their hosts.

218 pages. $2.85.

THE INFLUENCE OF SEVERAL FACTORS ON THE ACTION OF PENICILLIN AGAINST SOME MEMBERS OF THE ENTEROBACTERIACEAE

(L. C. Card No. Mic 58-2416)

Dale Emil Bordt, Ph.D.
Michigan State University, 1955

Various factors were studied to determine their influence on penicillin action against selected members of the Enterobacteriaceae.

The medium used was the synthetic medium of Young, Begg and Pentz (1944) with lactose as the sole carbon source. In this medium 200 units of penicillin per ml were found to be bactericidal to Escherichia coli. Penicillin was most actively bactericidal when exposure took place after about six hours at 37 C, which corresponds to the length of lag of E. coli in this medium.

Dilution was not an effective means for reduction of penicillin where recovery of previously exposed organisms was desired. Penicillinase was found to destroy penicillin effectively and to allow recovery of previously exposed cells. A much higher concentration of the enzyme was required for recovery of cells exposed to penicillin than was necessary to inactivate the same amount of penicillin under identical conditions of time and temperature.

Salmonella pullorum was found to survive exposure to 200 units of penicillin per ml. provided a sufficient preincubation was employed before exposure. This was evidently due to the fact that penicillin is active only against growing cells. The addition of approximately one percent sterile fecal material resulted in a bactericidal action of penicillin against S. pullorum. This was presumably due to the fact that the fecal material contributed growth substances to the medium, and thus established the penicillin effect.

Sodium arsenite in proper concentration was shown to be bacteriostatic against members of the genus Salmonella, but not against other Enterobacteriaceae. Sodium arsenite in a 0.002 percent concentration in this synthetic medium protected certain salmonellae from penicillin activity even in the presence of one percent fecal material.

The presence of two percent tryptose and 0.02 percent cysteine in the plating medium materially enhanced the recovery of S. pullorum from exposure to penicillin.

The addition of 0.5 percent lactose and 0.005 percent triphenyltetrazolium chloride to the plating medium resulted in colonies of diagnostic significance. Lactose nonfermenting organisms reduced the tetrazolium salt and formed dark red colonies, while those producing acid from lactose in general failed to reduce the salt and remained colorless or only faint pink.

A bisphenol, 2,2'methylenebis-4-chloro-6-isopropylphenol, added to a level of 0.001 percent in the plating medium effectively inhibited certain gram positive cocci which survived penicillin exposure.

A series of human fecal specimens was examined to determine whether this penicillin enrichment technique could be used for the isolation of salmonellae from feces. The results of this limited series of examinations compare favorably with those obtained with several media presently used for routine diagnostic work.

Among the limitations of the method is the fact that certain organisms other than the salmonellae do survive exposure to penicillin and, when present in large numbers, produce overcrowded plates making isolation of typical colonies difficult. Organisms involved in this type of interference are (1) pseudomonads, (2) nutritionally deficient coliforms, (3) lactose non-fermenting or slow fermenting coliforms. Other limitations are the inability to recover quantitatively the salmonellae, and the relatively small inoculus necessary.

The method, with some modifications, could also be very convenient for isolation of naturally occurring biochemically deficient forms of bacteria. 117 pages. $2.00.

Young, E. G., R. W. Begg and E. I. Pentz. Inorganic nutrient requirements of Escherichia coli. Arch Biochem. 5:121-136. 1944.

THE ENHANCEMENT OF SPORULATION IN BACILLUS SPHAERICUS WHEN GROWN IN ASSOCIATION WITH ERWINIA ATROSEPTICA

(L. C. Card No. Mic 58-2205)

Robert James Brady, Ph.D.
University of Maryland, 1958

Supervisor: Dr. Michael J. Pelczar, Jr.

Selected strains of Bacillus sphaericus and closely related organisms which would not sporulate in liquid shaker culture of many peptone media were observed to sporulate when grown in the presence of Erwinia atroseptica under the same conditions. This enhancement of sporulation could also be accomplished by the addition of yeast extract to the peptone media under the same cultural conditions. The enhancement effect produced by yeast extract was generally less than that caused by E. atroseptica. Sporulation of B. sphaericus was observed to occur when the organism was grown in filtrates of E. atroseptica cultured in peptone media. Many other species of bacteria grown in association with B. sphaericus failed to produce this enhancement phenomenon.

From studies employing chemically defined media, the requirement of manganese was determined to be much higher for sporulation than the level required for vegetative growth. The optimum level of this ion for sporulation was found to be 10^{-6} molar.

Sporulation was observed to occur in pure cultures of B. sphaericus when cultured in chemically defined media. The degree of sporulation was markedly influenced by the particular amino acids in the substrate.

Several synthetic media, each containing a single amino acid, were found to support the growth of this organism. Those media containing DL-alanine, L-arginine, or L-histidine were determined to yield a much higher degree of sporulation than media containing L-glutamic acid or DL-aspartic acid. The degree of sporulation was quantitated

by plating unheated and pasteurized aliquots of the culture, and determining the per cent sporulation.

Those amino acids capable of individually supporting the growth of the organism, in a salt-glucose-vitamin solution, have been classified as being "pro-vegetative" or "pro-sporulative", with regard to their effect upon the growth of B. sphaericus under these conditions. In a medium containing both types of amino acids, it was observed that the pro-vegetative amino acid negates the effect of the pro-sporulative amino acid.

The pro-sporulative effect exerted by DL-alanine was found to be dependent upon its concentration in the medium. The highest degree of sporulation was observed to occur at a level of 0.35 mg/ml. Culturing B. sphaericus in concentrations above, or below, this optimum level resulted in a much smaller degree of sporulation.

From the examination of filtrates of E. atroseptica cultures grown in synthetic media, evidence is presented to support the theory that the enhancement of sporulation in peptone media is possibly due, in large part, to the selective removal of pro-vegetative amino acids by the associative organism. 86 pages. $2.00.

FROZEN STORAGE AND CERTAIN LIFE PROCESSES OF ESCHERICHIA COLI

(L. C. Card No. Mic 58-1761)

Harold Walter Bretz, Ph.D.
Purdue University, 1958

Major Professor: S. E. Hartsell

Previous literature had reported the isolation of a growth stimulatory substance, Factor S, from cells of Escherichia coli following storage at -9 C in phosphate buffer, but attempts to repeat that work were not successful either before or after modification of the assay and isolation procedures. Growth-promoting substances were isolated from non-frozen cells, but no increase of such substances was shown during storage of frozen cells.

Attempts were then made to elucidate the reason why cultures appeared to be stimulated in their growth characteristics following storage at -9 C. Freezing was not a mutagenic agent but proved to be a selective agent when intentional mixtures of organisms were stored together. The use of substrains which differed in their colonial morphology and were individualistic in their generation times made it easy to follow the proportion of fast or slow growing types during storage treatments at 37, 4, or -9 C. Some substrains may survive in mixtures but not alone for periods up to 10 months, and the death of one substrain in a mixture may give the appearance of selection for the other substrain. This selection varied with the temperature as well as the type of constituent organisms, but mixture behavior could not be predicted from the characteristics of the substrains stored separately.

Cells grown on yeast-extract, veal-infusion agar survived well during daily freezing and thawing in egg melange, while egg melange-grown inocula died rapidly, but lag and generation times varied randomly in a manner not attributable to the freezing experience. Washed cell suspensions which were 'starved' by aeration prior to frozen storage in phosphate buffer did not survive nearly as well as washed but non-aerated cells. The metabolic state of cells prior to frozen storage markedly influenced their response to the various treatments.

Other indicators of the effect of freezing were considered. No release of ultraviolet-absorbing substances could be found from frozen cells. Resazurin dye reduction proved to be correlated only with the number of viable cells present regardless of the freezing treatments imposed. Both Alcian blue uptake and the release of ninhydrin-positive substances appeared to result from a single exposure to freezing and were not increased with subsequent multiple freezing and thawing or after extended storage at -9 C.

Frozen stored E. coli cells were considered to be physiologically active when the adaptive enzyme, beta-galactosidase, was investigated at -9 C. When melibiose, the inducer, was present cell survival was greater than without it, and cells with pre-adapted enzyme activity remained most viable during storage. This suggests that some property of the cell structure related to protein metabolism is important in the evaluation of survival.

Sucrose (10%) as a diluent gave higher plate counts than the same defrosted sample diluted in buffer, thus indicating the greater osmosensitivity of some stored cells. Substrains differed in their responses when 10^{-4} M magnesium sulphate was added as a thawing agent, but the diluent, buffered-sucrose plus magnesium sulphate, gave counts consistently higher for both substrains than buffer alone. The substrains were diversely affected by the pH of the thawing agent as well as by thawing when charcoal was present. Several recovery systems used to reactivate irradiated cells offered no protective effect for thawing frozen stored E. coli. A specific thawing agent might be selected for studying pure cultures which would substantially increase survival counts. However, practical application of a thawing agent to frozen foods which provide such varying micro-environments does not appear feasible, but buffered-sucrose plus magnesium sulphate can probably be recommended as a diluent superior to buffer alone regardless of the storage menstruum.

Statistical evaluation of sampling errors showed that duplicate frozen stored suspensions varied significantly from each other while non-frozen cells did not. It was interpreted that stored cells are in a 'sensitive' state from which they can either be reactivated to grow on plate counts under the influence of a suitable thawing agent and/or diluent, or are already irreversibly dead when defrosted.

The data are interpreted to imply some mechanism other than a strictly physical one as the cause of death of bacteria at -9 C, namely one connected with the metabolic state of the cell before freezing, and a subsequent adaptive phenomenon during storage. It was speculated that these systems may be related to the cell wall or active transport mechanisms since osmotic fragility was a consequence of frozen storage for some cells. Other literature was cited to support this contention. 104 pages. $2.00.

SYNERGISTIC PIGMENT ENHANCEMENT OF PSEUDOMONAS AERUGINOSA

(L. C. Card No. Mic 58-2209)

Norman Walter Chmura, Ph.D.
University of Maryland, 1958

Supervisor: Dr. Michael J. Pelczar, Jr.

A combined culture of Serratia marcescens and Pseudomonas aeruginosa has been shown to manifest a pigment response beyond that which is found in a pure culture of P. aeruginosa grown in the same synthetic medium. This response is elicited if either a pigmenting strain or a non-pigmenting mutant of S. marcescens is used. Examination of the pigment of P. aeruginosa in a Beckman DU spectrophotometer indicates that there is no qualitative difference in the pigment produced in pure or mixed culture. The mixed culture phenomenon is characterized by a quantitative increase in pigment production.

The mixed culture response could be elicited by the coexistent growth of the two organisms or by growth of P. aeruginosa in a filtrate of S. marcescens grown in the same basal medium. Chromatographic examination of culture filtrates revealed the presence of amino acids not originally present in the basal medium. Amino acids identified on the basis of comparative Rf values were tested for their enhancing activity on pure cultures of P. aeruginosa. It was found that proline, an amino acid tentatively identified in the culture filtrate of S. marcescens, was highly stimulatory for pigment production of P. aeruginosa.

Comparative studies of the growth cycle of P. aeruginosa in pure and mixed cultures were carried out. The results indicate that P. aeruginosa reached a maximum population at least 36 hours sooner when grown with S. marcescens or in a filtrate of the latter organism than when grown in pure culture.

Further studies carried out on the filtrate of S. marcescens indicated the possibility that the phenomenon of mixed culture enhancement of pigmentation is due to more than a single factor. 94 pages. $2.00.

THE INFLUENCE OF COXSACKIE B-3 VIRUS INFECTION ON CATHEPSIN AND TRANSAMINASE ACTIVITIES OF MAMMALIAN CELLS IN CONTINUOUS CULTURE

(L. C. Card No. Mic 58-2146)

Richard Lane Crowell, Ph.D.
University of Minnesota, 1958

The destruction of mouse muscle by a Coxsackie virus suggested that enzymatic alterations may be responsible. Disadvantages inherent to use of infected animal tissues in vivo for enzymatic studies led to selection of a virus-host system of a more controlled nature. Coxsackie B-3 virus multiplies in a stable strain of human epithelial cells (HeLa) with concurrent visible destruction of the cells. This observation led to the hypothesis that virus infection a) stimulates the host cell to increase its natural production of proteolytic enzymes of the cathepsin group and b) increase in enzymes results in cellular destruction or cytopathogenic effect. To test this hypothesis studies were performed a) to characterize and quantitate catheptic activity of normal HeLa cells b) to compare quantitatively the catheptic activities of normal and virus-infected cell cultures as total culture homogenates at intervals from infection and c) to determine cellular proteolysis as measured by increase in non-protein nitrogen (NPN) in comparative studies of normal and virus-infected cultures. The method of Anson with modification was employed for the determination of catheptic activity of cell preparations. For comparative purposes catheptic activity was related to the total nitrogen (TN) content of the cultures. Contrary to anticipated findings, results of these studies showed for virus-infected cells at time of virus release and visible morphologic degeneration evidence of decrease in catheptic activity and no significant increase in NPN.

Knowledge of the wide distribution of transaminase in many animal tissues and of its importance to amino acid metabolism provided stimulus for investigation of aspartate-glutamate transaminase activity of cells in culture at intervals from infection with Coxsackie B-3 virus. Preliminary studies were performed to characterize and quantitate the aspartate-glutamate transaminase activity of HeLa cells by the method of Umbreit and co-workers. For comparative purposes transaminase activity was related to TN content of the cultures. Assays of total culture homogenates of normal and virus-infected HeLa cells revealed no alteration in transaminase activity. If aspartate-glutamate transaminase is important to virus synthesis, the relatively high endogenous activity of this enzyme in HeLa cells may permit replication of virus without additional production of transaminase enzyme.

To determine the extent to which cellular destruction accompanies synthesis and release of Coxsackie virus, experiments were performed to evaluate the integrity of host cells at intervals from infection as reflected by distribution of cathepsin and transaminase between fluid and cell phases of HeLa cell cultures. Transaminase occurred in the culture fluid subsequent to virus synthesis and release. This finding suggested that evidence for increase in extracellular transaminase can be employed as an indicator of cell necrosis by virus. No significant release of cathepsin into the culture fluid was found as consequence of virus infection. Comparative cell fractionation studies of normal and virus-infected cultures in 0.25 M sucrose demonstrated that catheptic activity remained in the particulate phase even after a large amount of virus was detected in the fluid phase of the infected cultures. Evidence for the particulate nature of cathepsin and its relative instability at 36.5° C may account for comparative differences in extracellular distribution of cathepsin and transaminase in virus-infected cell cultures.

The significance of these findings to virus replication is discussed. 144 pages. $2.00.

SEDIMENTATION CHARACTERISTICS OF THE T3 BACTERIOPHAGE OF ESCHERICHIA COLI B

(L. C. Card No. Mic 58-2418)

Richard James De Long, Ph.D.
Michigan State University, 1956

Some of the physical properties of the T3 bacteriophage of Escherichia coli B were investigated and, in particular, its sedimentation behavior. The specific volume of the T3 particle was 0.70 ml. per gram. Nitrogen analyses of the T3 bacteriophage revealed 9.3 per cent nitrogen. The nitrogen content of the infective T3 particle was 0.3×10^{-16} gram of nitrogen. The sedimentation constant was 469 Svedberg units. A single, sharp, symmetrical boundary, migrating at a constant rate, was observed. Sedimentation stability extended through pH 6 - pH 10. At pH 11 degradation of the bacteriophage occurred. Increased sedimentation rate was observed at pH 5. Equivalent diameters, calculated from sedimentation and infectivity data, were 45 mu and 76 mu, respectively. Particle weights, calculated from sedimentation and infectivity data, were 28×10^6 and 199×10^6, respectively. The particle size of the T3 bacteriophage, measured directly from electron micrographs of air-dried specimens, was 50 mu. The T3 particle's morphology was roughly spherical in air-dried preparations. Stubby "tails" were observed on some of the particles. 63 pages. $2.00.

MICROBIAL DECOMPOSITION OF SOME ORGANIC HERBICIDES AND RELATED COMPOUNDS

(L. C. Card No. Mic 58-2255)

John Drenkel Douros, Jr., Ph.D.
The Pennsylvania State University, 1958

The microbial decomposition of several organic herbicides and related compounds and the effect of some of these compounds on nitrification have been investigated. Herbicides used included 2,4-dinitro-o-sec-butyl-phenol (DNOSBP), ammonium salt of 2,4-dinitro-o-sec-butyl-phenol (Sinox W), triethanol amine salt of 2,4-dinitro-o-sec-butyl-phenol (Sinox PE), 2,4-dinitro-o-cresol (DNOC), 3-(p-chlorophenyl)-1,1-dimethylurea (monuron) and sodium salt of 2,2-dichloropropionic acid (Dalapon).

Decomposition was investigated by use of herbicide treated soils in modified Lees-Quastel percolators, by use of soil-inoculated herbicide-mineral salts broth incubated in shake flasks and by pure culture study of isolates obtained from percolators and shake flasks. Effect of herbicides on nitrofication was determined by use of the modified Lees-Quastel percolators. Soils employed included field and garden soils of central Pennsylvania.

Data obtained indicate that all compounds studied serve as energy sources for microorganisms of the soil and fail to persist in the soil under conditions favorable to microbial activity. Chlorine substitution was found to favor attack by the gram positive flora of the soil, usually Corynebacterium species, while on the other hand, the presence of nitro, carbamyl or cyano groups appears to favor attack by gram netative bacteria, usually members of Pseudomonas. Chlorination of a dinitro compound fails to remove it from the group attacked by Pseudomonas.

Pseudomonas species attacking the herbicides under study comprise two distinct groups within the genus. A few of the common species utilize the dinitro compounds as sources of energy but appear to be unable to utilize urea, 1,1-dimethylurea and Monuron as energy sources. A limited number of lesser known species of the genus were found to attack the latter compounds for energy and carbon. The urea derivative 1,3-dimethylurea was found to be available as a source of energy and carbon to both groups of organisms.

Study of the utilization of urea as an energy source revealed the importance of the oxygen supply as a determining factor in the amount of reproduction and the nature of the end products. With adequate aeration urea nitrogen is converted almost quantitatively to nitrate nitrogen by Pseudomonas desmolyticum. Under these conditions the organism fulfills the roles of both the heterotrophic ammonifiers and the autotrophic nitrifiers. Evidence suggests, however, that ammonia is not an intermediate in the oxidation.

All herbicides investigated depressed nitrification with applications of 25 ppm, the minimum employed in the study. In the case of Dalapon, 25 ppm, the inhibition persisted for less than one month. In the case of Monuron, 25 ppm, the period of depression was about three times the length of that with Dalapon. The dinitro herbicides were found to exert a depressing effect at this concentration over a period of almost two months. Depression following the second application of all herbicides under test was found to be of short duration, in no case lasting as long as three weeks when applied at a rate of 25 ppm.
90 pages. $2.00.

SOME FACTORS INFLUENCING THE GROWTH OF A METHANOBACTERIUM SPECIES

(L. C. Card No. Mic 58-2419)

Charles Woodbury Fifield III, Ph.D.
Michigan State University, 1956

A methane bacterium identical in most respects to Methanobacterium omelianskii was isolated by enrichment culture and partially purified. A modification of a medium suggested by Barker (1940) gave excellent results. Chlorides were substituted for the sulfates and cysteine replaced sodium sulfide as a reducing agent.

The presence of inert solids in the methane fermentation were advantageous. Asbestos proved to be the most satisfactory substance of those studied in respect to subculturing and staining of the organisms, as well as to the enhancement of gas production.

The measurement of oxidation-reduction potentials proved to be of value in determining the role of the inert solid. An apparatus was constructed for the simultaneous measurements of the potentials in several cultures or solutions or in the upper and lower portions of a medium.

The presence of asbestos in the culture medium prevented diffusion into the lower limits. Evidence points to the conclusion that the role of the asbestos is to supply an

environment where the oxidation-reduction potential may be lowered and maintained even the presence of oxygen and where enzyme systems and hence energy may be concentrated for the use by the slow metabolizing methane bacteria.

Oxygen is not lethal to the Methanobacterium omelianskii type organism. In this respect it does not differ greatly from other anaerobes.

Ethyl violet had little influence on the growth of the organism but sodium azide and penicillin exhibited a marked inhibitory effect. 74 pages. $2.00.

NITROGEN REQUIREMENTS FOR GROWTH OF BOVINE RUMEN BACTERIA

(L. C. Card No. Mic 58-2212)

James Joseph Gilroy, Ph.D.
University of Maryland, 1958

Supervisor: Dr. Raymond N. Doetsch

Certain rumen additives and nitrogen-rich materials have been studied for their ability to replace rumen fluid in a standard medium (RFA) in supporting growth of maximum numbers of bacteria from the rumen. None were suitable for this purpose though one material, Edamin, an enzymatic digest of lactalbumin, supported growth of approximately 90 per cent of the rumen bacterial population grown in RFA. Other materials tested supported growth of approximately 50 to 75 per cent.

Each of 89 microorganisms isolated from RFA grew in "reinforced clostridial medium" (RCM) and Eugonagar; some only after prolonged incubation. RCM and Eugonagar supported growth of about 50 per cent of the mixed microbial population which grew in RFA on primary growth outside the rumen. This suggested a change in the nutritional requirements of microorganisms subcultured from the rumen.

Nitrogen requirements for growth have been determined for 41 pure cultures of rumen microorganisms representing a wide variety of morphological and physiological types. Less than 20 per cent of the isolates were unable to assimilate one or more of the simple individual nitrogen substrates which included 18 L-amino acids, asparagin, urea and ammonium sulfate. Most suitable as nitrogen substrates were those nitrogen compounds which have a key role in the scheme of ammonia fixation. Thus, ammonium sulfate and aspartate supported growth of 49 per cent of the isolates studied, while asparagin and glutamate supported growth of 58 and 63 per cent respectively.

The small cocci studied assimilated starch and ammonium sulfate as well as a variety of individual nitrogen sources. Those which were chromogenic produced pigment only in media containing serine.

Isolates failing to grow in individual nitrogen sources generally were not able to assimilate mixtures of amino acids (CAA). Only 2 of 38 isolates were unable to grow in CAA supplemented with 0.05 per cent (w/v) peptone, while addition of 0.05 per cent (v/v) rumen fluid often resulted in a reduction in the yield of bacterial numbers in the medium. Other instances of growth inhibition by citrate and high nitrogen concentrations have been shown. "Glycine toxicity" was demonstrated at a level of 7 μM/ml for growth of total numbers of the mixed rumen population.

A technique, suitable for screening the nitrogen requirements for growth of many of the rumen microorganisms, has been employed. The technique followed as the result of the development of a basal medium which supports growth only in the presence of a nitrogen source which can be assimilated. An evaluation of the methods employed for determining nitrogen requirements for the rumen bacterial population has been made.

103 pages. $2.00.

DIFFERENTIATION OF MEMBERS OF THE GENUS CHROMOBACTERIUM BERGONZINI

(L. C. Card No. Mic 58-2421)

Robert Joseph Hans, Ph.D.
Michigan State University, 1956

A search was made for biochemical characteristics useful in differentiating members of the Genus Chromobacterium Bergonzini. It was shown that these organisms are alkaligenic in peptone media, so special emphasis was placed upon utilization of various carbohydrates in two peptone free media.

The organisms were found to be very sharply divided into two groups by growth temperature ranges and optimum temperatures. These characteristics were closely correlated with fermentation of four carbohydrates in peptone media, the utilization of 11 carbohydrates in peptone free media, hydrogen cyanide production, pigmentation, and gelatin liquefaction. Methylene blue thiocyanate reduction, nitrate reduction, ammonia production, tryptophane utilization, MRVP reactions, hydrogen sulfide production, and urea hydrolysis were found of no differential value.

Specific names are suggested for the two groups; one mesophilic and the other psychrophilic. 62 pages. $2.00.

PROPAGATION OF DENGUE VIRUS IN TISSUE CULTURE

(L. C. Card No. Mic 58-2138)

Susumu Hotta, Ph.D.
University of Washington, 1958

The in vitro cultivation of mouse-adapted dengue viruses (type 1 and type 2) in rhesus monkey tissue cultures was studied. A single experiment was conducted with cultures of human kidney cells. Virus content of the culture fluid was determined by intracerebral injection of white mice. Identification of the cultivated virus was based upon neutralization tests using type-specific antisera from rabbits immunized with mouse-passaged dengue virus of each type. The infected cultures were observed microscopically in the living state and after fixation and staining.

In cultures of rhesus testicular tissue embedded in chicken plasma clot and incubated in a roller apparatus, dengue virus persisted for relatively long periods of time. No definite evidence was obtained, however, as to whether or not the virus multiplied in this tissue culture system.

In cultures of rhesus kidney cells, treated with trypsin and grown in the stationary state on glass without plasma clot, dengue viruses of both type 1 and type 2 multiplied. Serial transmissions through a number of tissue cultures were possible.

The infected kidney cells exhibited degeneration which was visible under a microscope and was suppressed by the specific immune serum. The cellular degeneration produced by type 1 dengue virus was shown to parallel its infectivity for mice. A single experiment was carried out with rhesus kidney tissue embedded in chicken plasma clot and incubated in a roller apparatus. Presumptive evidence was obtained that dengue virus multiplied in this system of tissue culture.

In a single experiment, dengue virus was inoculated into cultures of trypsin-dispersed human cells derived from a tumor-bearing kidney. No definite evidence was obtained in this case that dengue virus multiplied.

A cytopathogenic agent was recovered from a tissue culture of apparently normal rhesus kidney. This agent was distinguished from dengue virus biologically and immunologically. 95 pages. $2.00.

RATE OF NITRIFICATION IN SOME IOWA SOILS AS INFLUENCED BY TEMPERATURE, REACTION AND POPULATION OF NITRIFYING BACTERIA

(L. C. Card No. Mic 58-2200)

Burns Roy Sabey, Ph.D.
Iowa State College, 1958

Supervisor: Dr. Lloyd R. Frederick

The formation of nitrate in different soils to which ammonium had been added was studied. Soil samples with greatly differing properties were incubated at several constant temperatures, initial pH, and initial populations of nitrifying bacteria. Nitrate determinations were made at frequent intervals to characterize the nitrification curve.

At 25° C and moisture near field capacity the maximum nitrification rates varied from 0 in a Clinton silt loam to 900 ppm of nitrogen per week in a limed, inoculated Taintor silty clay loam. In other soils and at other temperatures similar variations, but of less magnitude, occurred.

Although there were large variations in maximum nitrification rates in different soils at each temperature, the relative influence of each temperature on these rates appeared to be approximately constant. Relative maximum nitrification rates (R_T) were determined by setting the maximum rate at 25° C equal to 1.0 and by comparing it to the maximum rates at other temperatures. Mean temperature rate indices or R_T values of 1.0, 0.8, 0.5, 0.2, 0.15, and 0.01 at 25, 20, 15, 10, 5 and 0° C, respectively, were obtained from the soils studied.

If similar data were available for the other factors that influence rate of ammonium oxidation, the amount of nitrate produced before conditions became limiting, might be estimated by a straight line equation which approximated the nitrification curve.

The amount of nitrate produced (N) in time (t) after ammonium application and before ammonium becomes limiting may be estimated by the relationship $N = K_F R_K (t - t_F r_t)$ where K_F is the maximum rate under favorable conditions; R_K is a factor based on the relative maximum nitrification rate and depends on environmental conditions; t_F is the lag period under favorable conditions; and r_t is a factor based on the relative lag period and depends on environmental conditions.

As temperature decreased below 25° C the lag period increased and the maximum rate decreased. When initial population of nitrifiers was low, increases obtained either by preincubation or by inoculation appeared to have little effect on maximum rates but markedly decreased the lag period. Decreases in soil pH below 6.5 increased lag periods and decreased maximum rates. Temperature, initial population of nitrifiers and pH influenced both R_K and r_t by varying amounts. The determination of rate indices for other influential factors, similar to the temperature rate indices here reported, would make possible an evaluation of the relative effects each factor has on the lag period and the maximum rate of nitrification.

104 pages. $2.00.

THE PRODUCTION OF ANTIBODIES BY HEN'S SPLEEN AND CORNEA TRANSPLANTED TO THE CHORIOALLANTOIC MEMBRANE OF THE CHICK EMBRYO

(L. C. Card No. Mic 58-1240)

Louis Richard Sibal, Ph.D.
University of Colorado, 1957

Supervisor: Professor Richard Thompson

Various investigators have observed that lymphoid cells obtained from adult animals previously injected with antigen continued to produce antibody when transferred to normal and x-irradiated adult recipients, neonatal recipients and to tissue cultures. It is generally accepted that the chick embryo is incapable of producing antibodies. A wide variety of cells and tissues have been successfully grafted onto the choricallantoic membrane of the developing chick embryo. In this investigation, the production of antibody by adult hen lymphoid (spleen) and corneal tissue growing on the chorioallantoic membrane was studied.

Antibody concentrations in fluids of inoculated egg membranes were determined by Boyden's method of agglutination of tanned red cells to which specific antigen had been adsorbed. Preliminary experiments showed that antibody placed on the choricallantoic membrane remained there for at least 6 days. Whole spleen emulsions or white cell suspensions from donor hens killed 36 and 48 hours after a single intravenous injection of bovine serum albumin produced measurable amounts of antibody in 4 to 7 days after transplantation to the chorioallantoic membrane of chick embryos. The probability that the transferred cells were primarily responsible for the synthesis of antibody is supported by the following observations. Spleen cells were devoid of detectable antibodies at the time of transfer. It was confirmed in these experiments that the chick embryo is incapable of producing antibodies; therefore, the presence of antibody was not the result of direct stimulation of chick embryo cells by antigen carried over in the cell inoculum. It is not likely that the cells contributed

some nonspecific factor that might enable the chick embryo to produce antibody, since antibody in the egg membrane fluids was demonstrated earlier than would be expected following a primary injection of antigen even in the adult donors. When splenic tissue was obtained from normal or previously-stimulated hens and treated in vitro or in ovo with specific antigen, antibody was not detected in the egg membrane fluids. Antibody was demonstrated in only one instance following the transplantation of adult corneal tissue previously injected with alum-precipitated bovine serum albumin.

Although spleen cells removed during the early stages of antibody formation continued to form measurable amounts of antibody after transfer to the chorioallantoic membrane, antibody synthesis could not be initiated when cells were obtained from normal and previously-stimulated hens treated with antigen in vitro or in ovo. 92 pages. $2.00.

STUDIES ON THE BACTERICIDAL ACTIVITY OF CHLORAMINE-T

(L. C. Card No. Mic 58-2368)

Jack M. Tadman, Ph.D.
Michigan State University, 1955

A study was made on the inter-relationship of pH, ionic strength, and concentration of chloramine-T. It was determined that a change in pH produced the most profound change in bactericidal activity with ionic strength and concentration of chloramine-T being of lesser importance. A direct relationship was found to exist between the concentration of species present in the equilibria and the oxidation-reduction potential, thereby giving a measure of bactericidal activity as determined by oxidation-reduction potential.

A technique for the use of chloramine-T as a restaurant sanitizing agent is also given. This technique can be used in any eating or drinking establishment that utilizes a three tank wash and sanitizing system. After the utensil is cleaned with a detergent in the first tank, it is dipped in the second tank containing an acid rinse. The acid rinse neutralizes the alkalinity of the detergent and places an acid film on the utensil. When the utensil with the acid film is placed in the third tank containing chloramine-T, the chloramine-T is "activated" at the surface of the utensil by the lowering in pH, producing rapid bactericidal activity. The acid rinse is substantially buffered with citric acid at a pH of 4 and the chloramine-T solution is buffered at a pH of 8 with KH_2PO. It is possible with this method to have a rapid acting sanitizer that is stable and odorless.

50 pages. $2.00.

THE NUTRITIONAL REQUIREMENTS OF A FEW STRAINS OF STAPHYLOCOCCI IN RELATION TO COAGULASE PRODUCTION

(L. C. Card No. Mic 58-1245)

Hamdi Ahmad Tamimi, Ph.D.
University of Colorado, 1957

Supervisor: Instructor Darwin Alonso

The most important single test for the differentiation of staphylococci into pathogenic and nonpathogenic strains is the coagulase test. Pathogenic strains elaborate this substance, which has the property of coagulating human plasma. Because of the importance of coagulase in the pathogenesis of staphylococci, many workers have attempted to isolate it and determine its physical and chemical properties. Coagulase, however, has not been obtained in purified form; only partially purified preparations obtained from complex laboratory media were investigated. The results reported by these workers are contradictory. These controversies may be due to the method and degree of purification of the preparation investigated. Therefore, it is important to obtain a much more purified coagulase preparation than has thus far been obtained. One method of obtaining such a preparation is the isolation of coagulase from chemically defined synthetic media. Coagulase preparations thus obtained might not be contaminated with the high molecular components of complex media, particularly the non-dialyzable components. Previous workers have failed to demonstrate coagulase activity in simple media inoculated with coagulase positive strains. In this investigation a very active preparation has been isolated from a synthetic medium composed of glucose, salt solutions, vitamins and amino acids.

In conducting this investigation, another objective was the demonstration of any possible relationship between the growth requirements of coagulase positive staphylococci and the ability of these organisms to elaborate coagulase in the medium. Little information is available on this subject. Moreover, it has been reported that coagulase positive strains inoculated in arginine-deficient medium have failed to produce coagulase. The same strains produced coagulase when inoculated in media containing arginine. Therefore, the growth requirements of three groups of staphylococci (4 coagulase positive, 2 coagulase negative, and 2 noncoagulase producing mutants derived from a coagulase positive strain by irradiation) were investigated. The organisms were inoculated in chemically defined synthetic media composed of glucose, salt solutions, vitamins, and amino acids--the amino acids were systematically eliminated one at a time--and the amount of growth and coagulase in these media were measured and compared. It was anticipated that such a comparison might reveal an essential difference in relation to coagulase production.

The data obtained in this study indicate that probably no direct relationship exists between the production of coagulase by coagulase positive staphylococci and any specific nutritional requirement that has been investigated. All coagulase positive strains that were capable of growth in the synthetic media were capable of elaborating coagulase in the supernatant fluid. A chemically defined synthetic medium capable of supporting growth has been found equally capable of supporting coagulase production by these organisms. Each of the coagulase positive strains

was found to grow in at least two dissimilar combinations of amino acids. Following growth, coagulase activity was demonstrated in the supernatant fluid. No essential difference could be demonstrated between the amino acid requirements of the coagulase positive and the coagulase negative strains.

Two coagulase positive and one coagulase negative strain were able to multiply in synthetic media containing arginine as the only source of organic nitrogen. The same organisms grew in similar media containing amino acids other than arginine. The growth of the coagulase positive strain and its noncoagulase producing mutants were, to a large extent, qualitatively and quantitatively, identical.

90 pages. $2.00.

A PARTIAL AND COMPARATIVE EVALUATION IN MICE OF AN ALUMINUM PHOSPHATE ADSORBED ANTI-SWINE ERYSIPELAS BACTERIN PREPARED BY THE SONIC BACTERIOCLASIS OF ERYSIPELOTHRIX RHUSIOPATHIAE

(L. C. Card No. Mic 58-2369)

Loyd Wayne Tiffany, Ph.D.
Michigan State University, 1955

Attention was directed to an apparent increase in swine erysipelas and to the economic loss which accompanied this infection. The need of more acceptable prophylactic and therapeutic measures for controlling this disease was stressed. Procedures for challenging experimental animals and methods of prophylaxis available at the present time have been discussed.

The object of this problem was the production and evaluation of a bacterin which consisted of formalin killed, sonically disrupted cells of Erysipelothrix rhusiopathiae adsorbed onto the surface of aluminum phosphate particles.

Three strains of E. rhusiopathiae were selected for the production of bacterins. The cells were killed by the addition of 0.3 per cent formalin to the cultures and were separated from the medium by centrifugation. These cells were then disrupted by sonic energy and adsorbed onto aluminum phosphate. The medium used for cultivation of the cells was also adsorbed with aluminum phosphate and the adsorbate products combined with the cell adsorbate. White mice were used to test these products against a challenge of undiluted virulent culture and against a challenge of 300 LD_{50}.

Strain 14774 did not protect any of the test animals and strains SE-9 and SE-25 protected 100 per cent of the animals, injected with the undiluted bacterin, against the challenge of undiluted culture. Against a challenge of 300 LD_{50}, bacterin SE-9 protected 100 per cent of the animals in a dilution of 1-4 and SE-25 protected 100 per cent of the animals in a dilution of 1-2 against a similar challenge.

A commercial bacterin was evaluated for the purpose of comparison and proved to offer greater protection than either of the experimental products. It protected 100 per cent of the animals in a dilution of 1-2 against a challenge with undiluted culture and 100 per cent of the animals were protected against a challenge of 300 LD_{50} in a dilution of 1-8 of the commercial bacterin.

Considering the variables present, for which more refined evaluation is indicated, the most important development of this work was the promise which this procedure offers for the development of an acceptable bacterin.

47 pages. $2.00.

A SEROLOGICAL ANALYSIS OF ISOLATED CELLULAR STRUCTURES IN BACILLUS MEGATERIUM

(L. C. Card No. Mic 58-1478)

John Wesley Vennes, Ph.D.
University of Michigan, 1957

A unique, direct approach to several problems in both cytology and immunology became possible through new techniques for isolating and purifying all of the major structural components of a representative bacterium, Bacillus megaterium. The following structures and some of their chemical fractions were isolated; flagella, capsular polypeptide, cell walls, cell wall polysaccharide, cell wall protein, protoplasts, protoplast (cytoplasmic) membranes, nuclear membranes, intracellular particles, spores, and spore coats. When these components were analyzed in comparison with the intact bacterium by means of conventional serological techniques, the following observations and conclusions were made:

1. Previously described methods for isolating the various cellular components were verified and a new method for obtaining protoplast membranes was developed. Chemical and enzymatic criteria were employed for evaluating the purity of these preparations. It was also reasoned that the isolated protoplast membrane probably was not denatured by the methods used.

2. All the isolated structures were shown to be antigenically distinct. This essentially complete failure of one structure to react serologically with another also provided an extremely sensitive criterion of purity for the preparations.

3. Injection of whole cells into rabbits was found to stimulate formation of antibodies to all the cell structures that are antigenic.

4. The so-called "surface" antigens of the intact normal cell were identified with the cell wall; moreover, the polysaccharide but not the protein fraction of the cell wall was associated with this reaction between whole cells and antibody to whole cells. Capsular polypeptide or flagella when present have long been known to react as surface antigens, but their presence was not found to inhibit the reaction with cell wall polysaccharide. The protoplast membrane was not found to be available for reaction when whole cells were used as the reacting antigen.

5. The medium used in growing cells was demonstrated to influence the antigenic structure of the cell produced, in the sense that encapsulated, flagellated, or sporulated cells required different conditions for growth. The presence of these components thus could be controlled and were not an important factor in the serological reactions. Capsular polypeptide was not found in cell walls isolated from unencapsulated cells, and the purified capsular polypeptide did not contain detectable levels of cell wall polysaccharide.

6. It was concluded that antibody globulin does not

penetrate the cell wall of this bacterium, a finding substantiated by several lines of serological evidence. Moreover, lipase protein, although lytic to protoplasts, had no apparent effect on whole cells or on protoplast formation from lipase-treated, washed cells and apparently it too does not penetrate the cell wall.

In contrast, antibody to cell walls appeared capable of either penetrating the capsule of encapsulated cells or, alternatively, the capsule did not completely cover the wall. Experiments on antibody penetration of the protoplast membrane were inconclusive.

7. Spore coat antigens were found to be distinct from antigens of the vegetative cell. Unlike the reactions with cell walls, intact spores were found to absorb all antibodies to spore coats.

106 pages. $2.00.

BIOLOGY — GENETICS

THE EFFECTS OF DESOXYCORTICOSTERONE TRIMETHYL ACETATE, DESOXYCORTICOSTERONE ACETATE, CORTISONE ACETATE, AND ADRENALECTOMY ON THE LIVER SUCCINOXIDASE AND GLUTAMIC DEHYDROGENASE ACTIVITY OF RATS FED 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE (3'-Me-DAB)

(L. C. Card No. Mic 58-1499)

John P. DaVanzo, Ph.D.
The University of New Mexico, 1958

The succinoxidase activity in preneoplastic liver tissue of male Long-Evans rats fed a purified diet containing 0.058 per cent 5'-methyl-4-dimethylaminoazobenzene for five months was demonstrated to decrease progressively from one to five months with a concomitant increase in liver weight during this period. Treatment of the adrenalectomized, azo dye-fed animal with desoxycorticosterone trimethyl acetate (DCT) in doses ranging from 50 mg. to 250 mg. resulted in complete inhibition of carcinogenesis so long as there was no regeneration of adrenal cortical tissue. Succinoxidase activity was markedly increased over the intact animals maintained on the carcinogen without hormone therapy and conversely the average liver weight was greatly reduced. The liver succinoxidase activity of DCT-treated animals with regenerating adrenals approximated that of the intact control animals on the azo dye which received no hormone therapy. Adrenalectomized animals given a single subcutaneous dose of 150 mg. DCT and maintained on the carcinogenic diet for five months survived very well, whereas the adrenalectomized animals given a single 50 mg. dose of DCT survived poorly.

The liver succinoxidase activity of azo dye-fed, intact animals receiving high and low doses of DCT was not significantly elevated over the control animals receiving the carcinogen for four or five months. The average liver weight of these animals, however, was intermediate between that of the adrenalectomized, protected animals receiving DCT and the intact animals receiving no hormone therapy.

The liver succinozidase and glutamic acid dehydrogenase activity of azo dye-maintained, adrenalectomized animals receiving 400 mg. desoxycorticosterone acetate (DOCA) over a period of 20 weeks was found to be markedly increased over intact animals maintained on the carcinogen but receiving no hormone treatment. The average liver weight of the treated animals was greatly reduced compared to that of the untreated animal. The enzyme activity of intact animals receiving 400 mg. DOCA over 20 weeks was intermediate between that of the adrenalectomized, treated animal and that of intact, untreated animals. The average liver weight of the intact animal treated with DOCA was found to lie between that of the adrenalectomized, treated animal and that of the untreated control maintained on the carcinogenic diet.

The succinoxidase and glutamic dehydrogenase activity of the azo dye-fed, adrenalectomized animal maintained on a solution containing 5 per cent glucose and 1 per cent saline, but given no hormone therapy was found to be slightly higher than that of the intact animal treated with 400 mg. DOCA. It was considerably lower, however, than that of the adrenalectomized animal treated with an equal quantity of hormone and having no adrenal regeneration.

Cortisone was shown to accelerate the carcinogenic process in animals maintained on a purified diet containing the azo dye 3'-methyl-4-dimethylaminoazobenzene. Whereas hepatomas develop in three months in animals maintained on this dye without hormone therapy, with cortisone treatment the tumors were well developed by two months. Adrenalectomy did not appear to protect the cortisone-treated animal.

Our results, therefore, indicate that adrenalectomy combined with DOCA or DCT therapy produces a cumulative anticarcinogenic effect in rats maintained on a low riboflavin purified diet containing the carcinogen 3'-methyl-4-dimethylaminoazobenzene. 64 pages. $2.00.

THE DEVELOPMENT OF COLCHICINE-INDUCED AND NATURAL POLYPLOID BREEDING LINES IN THE GENUS RUBUS (TOURN.) L.

(L. C. Card No. Mic 58-2215)

John Winter Hull, Ph.D.
University of Maryland, 1958

Supervisor: Dr. Donald M. Britton

Colchicine-induced polyploidy -- "colchiploidy" -- was produced in a wide variety of species and interspecific hybrids of Rubus (Tourn.) L. In all these forms, the same method of treatment was effective in producing internal (L-2) polyploidy. This method consisted of immersing

seeds at the cracked seed-coat stage of germination in an aqueous solution of 0.2 per cent colchicine plus 5 per cent glucose. Treatment was made at 86° F. for 9 hours. Treatments at all later stages of development were less effective or completely unsuccessful.

Several thousands of colchicine-treated seedlings of different forms of Rubus were screened visually for internal (L-2) colchiploidy while still in small (3-inch) pots. The basis for selection was certain morphological alterations in the leaf which were found to be specific for particular levels of ploidy in the derivatives of the second histogenic layer (L-2) of the shoot apex. Determination of internal (L-2) colchiploidy on this basis was found to be applicable to all types of Rubus seedlings that were treated. These same characteristics enabled elimination of individual canes, branches, and fruiting laterals of non-colchiploid nature which developed in the chimeral seedlings, as well as identification of maternal haploids and plants developing from unreduced fertilized eggs.

Fertile individuals were found at the 4X and 6X levels of colchiploidy, but not at the 8X level. Where the desired combination of genomes involved the use of a colchiploid 8X parent, that combination was achieved by the crossing of appropriate non-colchiploid parents, and then inducing polyploidy in the hybrid -- e.g., colchiploid 6X seedlings of tetraploid blackberry x diploid raspberry. Also, the functioning of unreduced fertilized eggs was frequent enough to be utilized in producing combinations of genomes which could not be achieved through colchiploidy.

In addition to their female sterility, the higher colchiploids, in particular, produced super-reduced male gametes, which were strongly favored in effecting fertilization. However, many of the lower colchiploids, as 4X blackberries, black raspberries, and red raspberries, showed promise for the development of breeding lines in their own right, as well as serving as parents in wide crosses.

Fruit size was increased by colchiploidy, but the degree varied with the ploidy of the third histogenic layer (L-3) between otherwise comparable colchiploid plants. In order to evaluate fruit size and certain other horticultural characteristics, selection of permanent breeding lines had to await production of non-chimeral progenies from the chimeral colchiploids.

Individual mitotically unstable plants were found in many populations of colchiploid and naturally polyploid Rubi. Two (or more) spindles in the same cell at mitosis led to the formation of three (or more) daughter cells, two of which had a decreased chromosome number, and one of which was usually binucleate. In unstable plants below the ca. 6X level of ploidy, these "split divisions" produced cells apparently unable to develop independent growing points. In unstable plants above this level of ploidy, many cells resulting from split divisions were able to develop independent growing points (roots and adventitious shoots) and areas of mosaicism in the leaves. Propagation by leaf-bud cuttings or tip plants maintained the original unstable phenotype. Propagation by root cuttings produced plants with different phenotypes and decreased chromosome numbers which usually were stable.

Thornlessness from Austin Thornless blackberry was transferred to many dissimilar forms of Rubus at various levels of ploidy, in the F_1 generation. Eldorado blackberry was found to contribute thornlessness to certain of its F_2 progeny, but a simple recessive condition was not indicated. A thornless seedling of the chimeral thornless bud sport of Logan blackberry was produced. 130 pages. $2.00.

BIOSYNTHESIS OF ALPHA, GAMMA-DIAMINOBUTYRIC ACID IN BACILLUS CIRCULANS

(L. C. Card No. Mic 58-1804)

Yelahanka Krishnamurthy Srinivas Murthy, Ph.D.
Purdue University, 1958

Major Professor: Harold R. Garner

As a working hypothesis it was decided to test whether DABA might be synthesized in the fashion analogous to other diamino acids, namely lysine and ornithine. One such possibility placed aspartic acid in the precursor role. Another indicated glutamic acid as a more direct source. Hence, aspartic acid-U-C^{14} and glutamic acid-2-C^{14} have been used in isotopic competition experiments. The specific activities of compounds derived directly from glutamic and aspartic acids namely arginine and lysine were compared to the specific activity of DABA. The similarity of the arginine/DABA specific activity ratios and the dissimilarity of the lysine/DABA indicate that DABA is more directly related metabolically to glutamic acid than aspartic acid. 73 pages. $2.00.

A CYTOGENETIC STUDY OF CERTAIN TRANSLOCATION INTERCROSSES INVOLVING THE SAME CHROMOSOMES IN MAIZE

(L. C. Card No. Mic 58-2166)

Edgar Lewis Turcotte, Ph.D.
University of Minnesota, 1958

Adviser: C. R. Burnham

The production of individuals with a chromosome segment duplicated or deficient has generally been accomplished through the use of irradiation. However these have been produced in Drosophila, Datura, and maize by crossing individuals containing interchanges involving the same chromosomes, but with the breakpoints at different positions, a scheme proposed by Muller and probably independently by Blakeslee et al.

The purpose of the present investigation was to conduct a cytogenetic study of certain translocation intercrosses in maize, using the F_1 plants and certain backcross progeny for cytological examination and for genetic tests for deficiency.

Five different crosses between translocations involving the same two chromosomes but with the breakpoints at different positions, T2-6c x T2-6d, T3-7a x T3-7b, T1-9a x T1-9c, T2-6B x T2-6(6049), and T1-7a x T1-7b, were studied, the first three genetically and cytologically, the last two only genetically.

To test for the presence of a deficiency genetically, these intercrosses were crossed as female parents with plants containing recessive genetic markers presumably located at or near the loci involved in the translocations. Plants in the progenies of the backcrosses with a degree of sterility comparable to that of the F_1 were used also as female parents in crosses to the recessive testers.

Genetic evidence for the functioning of deficient female gametes was obtained from two of the intercross combinations. The F_1 of T3-7a x T3-7b and progeny of similar

type from the backcrosses, when crossed as the female parent with a floury-2 tester stock ($\underline{fl_2}$) produced floury kernels. The percentages were: 7.6 from the test of the F_1, 7.7 from the backcross to T3-7a, and 1.7 from the backcross to T3-7b. This indicates that $\underline{fl_2}$, an endosperm character whose linkage relations have not been determined, is probably either in the short arm of chromosome 3 or the long arm of chromosome 7.

The F_1 of T1-9a x T1-9c when crossed as the female parent with an argentia tester ($\underline{ar}$) produced 10.5 percent argentia progeny. Low sterile progeny (similar to the F_1) from the backcrosses of the F_1 to each parent translocation stock also produced argentia progeny when tested, 16.5 percent from the backcross to T1-9a and 15.8 percent from the backcross to T1-9c. These results indicate that the segment of the long arm of chromosome 9 containing the normal allele of $\underline{ar}$ was missing but that megaspores containing this deficiency were functional.

The results of the other genetic tests for deficiencies in the intercross combinations studied were negative.

Selfed argentia plants obtained from the genetic tests for deficiencies in the cross of T1-9a x T1-9c unexpectedly produced green plants in varying percentages. The explanation is not known.

Diakinesis in all the F_1's studied showed 10 "bivalents". Some of the cells from the intercross T3-7a x T3-7b had a "bivalent", probably chromosome 7^3, with homologues of unequal length.

The intercross T2-6c x T2-6d showed no loops in either chromosome 2^6 or 6^2 at pachytene. The average pollen abortion of the F_1 plants was 7.3 percent. These results suggest that the breakpoints of T2-6c and T2-6d are identical or nearly so. This is in disagreement with the published break-positions of these two translocations.

For T3-7a x T3-7b "T-shaped" configurations were observed for both chromosomes 3^7 and 7^3 at pachytene.

For T1-9a x T1-9c intercalary loops were observed in both chromosomes 1^9 and 9^1 at pachytene.

Pachytene analysis of argentia progeny derived from the genetic tests for deficiencies produced by T1-9a x T1-9c showed "H-shaped" chromosome complexes indicating the presence of non-homologous chromosome segments. The lack of homology was interpreted as being caused by the presence of a duplication and a deficiency for intercalary segments of chromosome 1 and 9 respectively. 86 pages. $2.00.

GENOTYPIC REACTIONS TO BOLL WEEVIL ATTACK IN UPLAND COTTON

(L. C. Card No. Mic 58-2382)

Wolfgang Heinrich Wessling, Ph.D.
North Carolina State College, 1958

Supervisor: Stanley George Stephens

A critical study of the reliability of resistance to boll weevil attack conferred by the mutant gene $\underline{H_2}$ to Upland cotton was made in 1956. The mutant strain Pilose was planted in different proportions with the susceptible variety All-In-One in an experiment in which each plot was isolated from the surrounding plots by corn. The treatments contained either 100% resistant plants or resistant and susceptible plants in the proportions 75% to 25%, 50% to 50%, and 25% to 75%. Boll weevil-infested squares were distributed in the experiment to obtain a uniform and high number of weevils in each plot.

The degree of resistance was measured by the proportional decrease in number of egg-laying punctures. The mutant strain Pilose showed a significantly higher reduction in number of egg-laying punctures throughout the investigation. The delay of egg-laying increased the effectiveness of resistance conferred by the mutant gene $\underline{H_2}$ in homozygous condition. A slight but consistent increase in number of egg-laying punctures with increase in the number of susceptible plants was noticed in the mutant strain Pilose as well as in the susceptible variety All-In-One.

Genotypic reactions to boll weevil attack of fourteen different strains of Upland cotton were tested in 1957 under similar experimental conditions as the experiment in 1956. The strains tested combined any two of the following four mutant genes or their "normal" alleles: $\underline{H_1}$, conferring hairs to the lower surface of the leaf, to stem and petioles; $\underline{H_2}$, conferring a dense, short hair cover to the entire plant; $\underline{sb}$ conferring the deficiency of glands to stem, petioles, hypocotyl, and bolls; $\underline{R_1}$, conferring red color to the entire plant. The combinations of these mutant genes were chosen because they were shown or were expected from preliminary observations to confer various degrees of resistance to boll weevil attack. Strains carrying the opposite alleles to the mutant genes under consideration were included in the experiments to exclude differences in resistance due to difference in genetical background. The strains combining the genes $\underline{H_1}$, $\underline{R_1}$ and their opposite alleles were not included in the test for technical reasons.

All mutant strains showed varying degrees of resistance to boll weevil attack, the strains combining the genes $\underline{H_1}$ and $\underline{H_2}$ the highest degree, those combining the genes $\underline{sb}$ and $\underline{H_2}$, and $\underline{sb}$ and $\underline{H_1}$ ranking second and third. Strains carrying the gene $\underline{R_1}$ in combination with the mutant gene $\underline{sb}$ or $\underline{H_2}$ were tested in a separate experiment. Both showed a relatively high degree of resistance. All strains carrying the opposite alleles to the mutant genes were not significantly different from each other. No difference due to difference in genetical background can be assumed with respect to resistance to boll weevil attack. Mutant strains carrying the same mutant genes but differing in genetical background were also found not to differ significantly from each other.

Values of the combined main effects and interactions were calculated for the mutant genes $\underline{H_1}$, $\underline{H_2}$, and $\underline{sb}$ and were tested. Under the experimental conditions the gene $\underline{H_2}$ had the highest main effect and interaction, the mutant gene $\underline{H_1}$ to less an extent, while the mutant gene $\underline{sb}$ did not have any significant main effect and interaction. This does not exclude the possibility, however, that the mutant gene $\underline{sb}$ may confer a certain degree of resistance under natural infestation since the tests were extremely severe and not well suited to test the significance of the effect of the characteristics conferred by this mutant gene which may be expressed mainly by not attracting the boll weevils to the cotton plant. 67 pages. $2.00.

THE GENUS CLITOCYBE (FRIES) KUMMER IN MICHIGAN

(L. C. Card No. Mic 58-1378)

Howard Elson Bigelow, Ph.D.
University of Michigan, 1956

Nine hundred collections of Michigan Clitocybes were identified, representing eighty-one species and varieties. The following are described as new: Clitocybe aeruginosa, C. argillacea, C. avellaneifolia, C. brevipes, C. distantifolia, C. incisa, C. insipida, C. odorifera, C. pallescens, C. pallidula, C. pseudocandida, C. pseudorustica, C. pubescentipes, C. rancida, C. rubella, C. sordidula, C. sphagnorum, C. subcanescens, C. subcanescens var. robusta, C. subcinerea, C. subfragrans, C. subfumosa, C. submollis, C. subnitens. Species of the genus Omphalina Quélet, with the exception of those already transferred to Mycena and Xeromphalina by previous workers, are transferred to the genus Clitocybe. As a result, the following new combinations are made: Clitocybe asterospora (Lange), C. barbularum (Romagnesi), C. chrysophylla (Fries), C. epichysium (Fries), C. gibba var. maxima (Fries), C. onisca (Fries), C. postii (Fries), C. rustica (Fries), C. umbellifera (Fries).

In the past, type species have been proposed for the genus Clitocybe, but these did not satisfy the requirements of the International Rules of Nomenclature. A new lectotype, Clitocybe clavipes (Fries) Kummer, is proposed.

The genus is divided into sixteen sections. The sections Asterosporae, Piperatae, and Sclerotoideae are described as new. The sections Aspropaxilli (Kühner and Maire), Cantharellulae (Singer), Hygrophoropsis (Schroeter apud Cohn), and Omphalinae (Quélet) are new combinations. The sections Candicantes (Quélet) Konrad and Maublanc, Cyathiformes (Fries) Quélet, Disciformes (Fries) Quélet, Hygrophanae (Quélet) Singer, Infundibuliformes (Fries) Quélet, Olearíae Konrad and Maublanc, and Umbilicatae Singer have been emended.

Certain features of the fruiting body have been emphasized, more than in previous works, in separating taxa within Clitocybe. Spore characteristics, and the presence or absence of clamp connections have been found useful at a sectional level. The manner in which the pigment occurs in the carpophore, and the color of the spore deposit, are valuable for distinguishing species.

It is now known that the Clitocybe season in Michigan extends from April through November. The majority of species, sixty-eight per cent of the total number, were found in the period of August through October.

Clitocybes were collected in most of the diverse plant habitats existing in Michigan. About seventy per cent of the species occur in forested areas, on humus or on decaying wood. Nearly sixteen per cent were found in exposed habitats (on sand, lichens, mosses). The remaining percentage was divided about equally among species occurring on grassy areas, sphagnum bogs, or on burned vegetative material. 296 pages. $3.80.

MOSAIC OF JATROPHA GOSSYPIFOLIA IN RELATION TO THE LEAF-CURL VIRUS OF TOBACCO IN PUERTO RICO

(L. C. Card No. Mic 58-1151)

Julio Bird-Piñero, Ph.D.
University of Minnesota, 1957

Adviser: T. H. King

A virus disease of the euphorbiaceous weed Jatropha gossypifolia was studied in the present investigation. The research was part of a program directed to determine possible relationships between virus diseases of weeds and those of certain plants of economic value. The symptoms of the disease on Jatropha gossypifolia as well as on tobacco plants closely resemble those reported in various parts of the world as typical for the tobacco leaf curl virus disease. Leaf-like and cup-like enations are evident on some of the leaves of the most severely affected plants. Attempts made to transmit the causal virus through dodder and by inoculation with expressed sap were unsuccessful. Also the virus is not seed transmitted.

Transmission of the virus was accomplished by grafting healthy plants of Jatropha gossypifolia with infected scions from the same species. A series of plant species within the genus Jatropha develop symptoms of the disease when grafted with infected scions from Jatropha gossypifolia. The white fly Bemisia tabaci was found to be the vector of the causal agent of the disease. Transmission of the virus through this insect was effected when healthy Jatropha gossypifolia plants were colonized with white flies previously fed on affected plants of the same species. A series of Jatropha species subjected to viruliferous white flies developed symptoms of the disease. Seedling tobacco plants (cotyledon stage) of the commercial variety Virginia 12 were successfully inoculated by white flies obtained from affected Jatropha gossypifolia plants. Tobacco plants beyond this stage failed to develop symptoms when treated with white flies from the same source. Older plants are however susceptible to the disease when inoculated by means of grafting.

Various means were employed to secure virus-free stock cultures of the insect vector. Obtainment of such virus free stock cultures of the vector enabled the writer to study some relations between the vector and the virus.

Bemisia tabaci requires a minimum acquisition feeding period of 2 hours on infected Jatropha gossypifolia plants. A minimum inoculation feeding period of 10 minutes on healthy Jatropha plants was required by white flies of the same species. Single viruliferous white flies were found to be efficient vectors of the causal agent.

The Jatropha virus remains in the insect vector for more than one day; and this places the virus among the ones recognized as persistent by many investigators.

The possibility of the existence of the leaf-curl disease of tobacco in the tobacco fields in Puerto Rico was anticipated after its appearance in the greenhouse. Surveys

confirmed the existence of a similar disease in many of the tobacco growing areas of the Island. Evidence obtained in these studies strongly indicates that a close relationship exists between the leaf curl diseases of tobacco and the mosaic of Jatropha gossypifolia in Puerto Rico. The symptomatology of the leaf curl virus diseases of tobacco in Puerto Rico, East Africa and India is similar if not identical. 50 pages. $2.00.

THE FUNGUS FLORA OF CATTLE FEEDS: TAXONOMICAL, CULTURAL AND ECOLOGICAL ASPECTS

(L. C. Card No. Mic 58-2256)

Robert DuBois Bonner, Ph.D.
The Pennsylvania State University, 1958

Previous studies have indicated that certain fungi commonly found on feeds, such as silage and grain, may produce allergies or pathological conditions in cattle and other livestock. In recent years frequent losses of livestock in the state of Pennsylvania due to the feeding of moldy silage or grain to livestock have been brought to the attention of veterinarians.

The present work is a taxonomical study of the fungus flora associated with feeds that were suspected to be the source of toxins, allergenic substances or pathological agents. Non-suspected feeds were studied for comparative purposes. Cultural and ecological aspects of the problem were investigated in connection with some or all species isolated.

The feed samples studied were obtained from the Veterinary Research Center and the Animal Nutrition Laboratory, both of the Pennsylvania State University. Feed samples were analyzed for pH and for the per cent moisture content of the substrates. Attempts were made to determine the physical makeup, i.e., the type of vegetable matter comprising the substrates, the numbers and kinds of microorganisms (other than fungi) present and the occurrence of soil, debris and other contaminants.

The per cent moisture content and pH of most samples were conducive to actively developing fungus species usually referred to as "molds." Dormant inocula of some species are believed to have been introduced on the substrates under conditions not generally favorable for their development. These fungi are regarded as potential producers of toxins or other disorders if conditions become favorable for their growth and development prior to their consumption by farm animals.

Special techniques were adapted for isolation of a variety of fungus species by the use of special agar media. Malt salt agar proved to be the best medium for general isolation studies. Discrete colony formation on this medium allowed for quantitative counts of a large number of diverse fungus species. Littman oxgall agar was bacteriostatic and permitted separation of fungi and bacteria that were intimately associated. Several species not encountered on malt salt agar were isolated on this medium. Malt extract and potato dextrose agars generally permitted rapid growth of the so-called "molds." Czapek Dox was highly specific for isolation as well as culture of members of the Aspergillaceae and certain Moniliaceae.

Sixty-five species representing 3 classes, 7 orders, and 12 families were identified from suspected and non-suspected feeds. Thirty-eight of the 65 species were found on feeds that were not suspected of disease involvement. Two species, Arachniotus terrestris and Penicillium vermiculatum, were found on non-suspected feeds, but not on the suspected samples. More than one-third of the species isolated had histories of disease involvement in livestock.

A species of Ascocybe was isolated which differs from the only other known species, Ascocybe grovesii.

The influence of temperature and relative humidity on the growth of ten fungi was determined in order to clarify their influence on mold development under storage conditions. Four growth types based upon visual estimation of growth and dry mycelium determination were found to occur among the ten species, viz., 1) Fusarium moniliforme, Mucor Jansenni and Mucor racemosus, species that developed very rapidly in favorable environmental conditions; 2) Aspergillus fumigatus, Monascus purpureus and Penicillium purpurogenum, species that developed over a wide range of conditions and produced moderate amounts of mycelium (and spores); 3) Alternaria tenuis, Chlamydomyces palmarum and Cladosporium elatum, species that produced thick mycelial colonies under favorable conditions and thin growths in adverse environments; and 4) Oospora lactis, which was highly restricted under the conditions studied.

None of the fungi tested grew at 50°C., and only three species developed at a relative humidity of approximately 65 per cent. 107 pages. $2.00.

STUDIES OF INTERNAL CHEMICAL CHANGES OF THE POTATO TUBER IN RELATION TO DORMANCY

(L. C. Card No. Mic 58-2350)

Cosimo Cotrufo, Ph.D.
University of Missouri, 1958

Supervisor: Dr. Jacob Levitt

Potato tubers were stored at 3° C. from September, then half a tuber transferred monthly to 26° C. for 10 days and the corresponding halves compared. During two successive years, the alcohol insoluble N in the internal tissues increased to a maximum in the December tubers, decreased in the October tubers. At 3° C. the maximum alcohol insoluble N was in the January tubers. These results agree with five years' results obtained previously by direct protein extraction. In all cases, protein synthesis increased to a maximum during progress of the rest period. The first signs of sprouting occurred at the metabolic changeover from protein synthesis to protein hydrolysis.

Paper chromatographic analysis was made of the amino acids and amides, aspartic, lysine, arginine, glycine, phenylalanine, tyrosine, glutamic, gamma-amino butyric, leucine, alanine, serine, threonine, valine, glutamine and asparagine, of active and resting internal tissue of potato tubers. There were no large changes in the amino acids during the break of the rest period. There was a large increase in asparagine when the rest period was broken.

Exploratory semi-quantitative analysis was made of metal elements, Fe, Cu, Mg, Mn, Ca, spectrographically and Na, and K by flame photometry of protein particulates of the internal tissues of active and resting potato tubers. In addition, spectrographic qualitative evidence indicates that ten other metal elements, Al, Mo, B, Pb, Sn, Zn, Co, Ag, Cd, and V may also be determined semi-quantitatively. Mo appears to be the most promising. 82 pages. $2.00.

THE GENUS Salix IN THE BLACK HILLS OF SOUTH DAKOTA: A PHYTOGEOGRAPHICAL STUDY

(L. C. Card No. Mic 58-1210)

Sven Gorden Froiland, Ph.D.
University of Colorado, 1957

Supervisor: Associate Professor William A. Weber

The Black Hills area of South Dakota is one of the most critical in North America from a phytogeographic standpoint. The climatic variability, geographic location, and variable topography have combined in this relatively restricted area to produce an extremely interesting and diverse flora. Here, the Cordilleran flora, the Plains flora, the Northern Lowland flora, and the eastern Deciduous Forest element all meet and overlap. There is evidence that this sort of overlap was once widespread along the East Slope of the Rocky Mountains but now occurs principally in the Black Hills. Mention has been made of these elements, but no detailed study of the general distribution patterns of any single group has been attempted. It was felt that a thorough taxonomic and distributional study of the genus Salix in this area might yield information that would be of value in solving the problems of the peculiar plant distributions in the Black Hills. The genus Salix was selected because it includes representatives of all the geographical elements involved.

The investigation also included a more practical phase. Dead and apparently dying willows are common in many places in the Black Hills. The death of willows has been attributed to various causes in the past. Statements concerning the mortality of the willows have always been made on a generic basis. As a result the condition or status of the individual species, as well as the extent or seriousness of the mortality has remained unknown. A necessary first step in attacking this problem was to determine the willow species present in the Black Hills, and the taxonomic characteristics, geographical distribution, and the present status of each.

Multiple collections were made and extensive field data recorded for each collection. The paper includes: a key based on vegetative characteristics; taxonomic descriptions, maps of continental and Black Hills distributions, and photographs of each species; notes on field identification, site requirements, vigor and abundance.

Twenty-one species or varieties were collected, of which one is Eastern North American, two are North-East North American, three are Boreal, three are Central North American, nine are Cordilleran, one is Western North American, and two are introduced forms. The Eastern, North-Eastern, and the majority of the Cordilleran forms are rare or only moderately abundant in the Black Hills. The Boreal, Central North American, the single Western, plus one Cordilleran form, are abundant and widely distributed.

The Eastern and North-Eastern forms reach the western limit of their range in the Black Hills, the Cordilleran and Western forms reach the eastern limit of their range, and the Boreal forms reach their southern limits here. The resultant overlap reflects the same geographic pattern that is characteristic of the flora of the region as a whole.

Solely on the basis of distributions within the genus Salix, the Black Hills cannot be divided into phytogeographic areas. However, the central portion of the region is the "willow zone" for the Black Hills. Every species that occurs in the Hills occurs here, many forms are restricted to this area, and very few species are found outside this area. The mountain forms occupy a mountain habitat, the Eastern, North-eastern, and Boreal forms occupy cool, wet habitats, all juxtaposed in this relatively restricted area. As would be expected, moisture apparently is the limiting factor for willow distribution in the Black Hills. Additional taxonomic, distributional, and ecological studies involving genera that are not as moisture-limited as the willows are indicated before the problem of the geography of the Black Hills flora can be solved. Also indicated is a thorough study of the soil to supplement the proposed distributional analyses. It is hoped that such studies, collectively, may reveal a pattern.

The investigation was carried out under the immediate supervision and close cooperation of the Research Center of the Rocky Mountain Forest and Range Experiment Station, Rapid City, South Dakota. The collections and field data are deposited at Augustana College, Sioux Falls, South Dakota, and the Herbarium of the University of Colorado, Boulder, Colorado. Complete collections have also been deposited in several North American herbaria.

264 pages. $3.40.

CHEMICAL REACTIONS INVOLVED IN THE FUNGITOXICITY OF CAPTAN

(L. C. Card No. Mic 58-2219)

Raymond James Lukens, Ph.D.
University of Maryland, 1958

Supervisor: Dr. Hugh D. Sisler

Studies were conducted to determine the chemical basis of the fungitoxicity of captan (N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide) to Saccharomyces pastorianus Hansen. The toxicity of this fungicide increases as the initial pH of the medium decreases over the range of 7.5 to 4.5. The sulfhydryl compounds cysteine, homocysteine, glutathione, coenzyme A, and thioglycerol destroy the fungitoxicity of captan if they are added to yeast cultures simultaneously with or before the fungicide. Cysteine at three times the molar concentration of captan is sufficient to protect completely yeast cells from the toxicity of this fungicide.

Cysteine reacts with captan in vitro. The products of this reaction are cystine, tetrahydrophthalimide, hydrogen sulfide, carbon disulfide, 2-thiazolidinethione-4-carboxylic acid, and hydrochloric acid. The trichloromethylthio group

and thiophosgene are apparently intermediates in the formation of 2-thiazolidinethione-4-carboxylic acid, since the latter compound could also be formed by reacting trichloromethylsulfenyl chloride or thiophosgene with cysteine. While captan does not appear capable of reacting with other than sulfhydryl groups, the trichloromethylthio group or thiophosgene released from captan by sulfhydryl groups are apparently capable of reacting with amino, hydroxyl, sulfhydryl, and possibly other groups. Histidine and serine react with thiophosgene to form ultraviolet absorbing compounds. When serine is present in mixtures with captan and cysteine, an ultraviolet absorbing compound is formed which has a chromatographic Rf value and an ultraviolet absorption spectrum identical with that of a compound formed in the reaction of thiophosgene and serine.

Carbon disulfide and hydrogen sulfide are evolved from thiophosgene is aqueous suspensions. These two gases are also evolved when captan reacts with cysteine in aqueous or alcoholic solutions. The formation of carbon disulfide from captan or thiophosgene probably involves a di(thiophosgene) intermediate. A compound with the melting point of di(thiophosgene) was isolated from aqueous solutions containing thiophosgene. Carbon disulfide, but not hydrogen sulfide, is evolved when yeast cells are treated with captan. The release of carbon disulfide from captan in yeast cultures suggests that thiophosgene is formed in the reaction of captan with cellular components.

Trichloromethylsulfenyl chloride is nearly as toxic to cells of S. pastorianus as captan, while thiophosgene is somewhat less toxic and tetrahydrophthalimide is nontoxic. This would indicate that the actual toxic portion of the captan molecule is the trichloromethylthio group. Thiophosgene, formed from the trichloromethylthio group is probably the ultimate toxiphore of captan. The function of the imide portion of captan appears to be that of regulating the penetration of the trichloromethylthio toxiphore into cells and of stabilizing this toxiphore so that it reacts only when released by certain sulfhydryl groups. In this manner, the imide may impart a specificity to captan at the cellular or enzyme level greater than that which is characteristic of the trichloromethylthio group or of thiophosgene.

The combination of thiophosgene with free sulfhydryl, amino, hydroxyl, and possibly carboxyl groups of the cell or a combination of the trichloromethylthio group through the free bond of sulfur to certain vital groups in the cell are considered to be the chemical reactions responsible for the fungitoxicity of captan. 60 pages. $2.00.

SOME EFFECTS OF HERBICIDAL OILS ON BEANS

(L. C. Card No. Mic 58-2371)

Mark G. Wiltse, Ph.D.
Michigan State University, 1955

The use of oils as herbicides dates back to the early 1900's. Research workers found that certain oil fractions could be used as selective herbicides. Oils were later used as directed sprays on onions, cotton and soybeans.

A study of the effects of oils upon soybeans (Glycine max, variety Hawkeye), field beans (Phaseolus vulgaris, variety Michelite), lima beans (Phaseolus lunatus, variety Fordhook Dwarf), wax beans (Phaseolus vulgaris, variety Pencil Pod Wax), green beans (Phaseolus vulgaris variety Tendergreen Bush) and weeds was undertaken in the fall of 1952 and field and greenhouse tests were conducted until the spring of 1955. Thirty-two experimental oils were tested in an effort to obtain an oil that was non-toxic to the bean stems but would give good weed control.

A power driven sprayer was designed and built to apply oils in the field as a directed spray, in a 6 inch band, at the base of the bean stems. A small DeVilbis sprayer unit was used for greenhouse oil application. All oils were applied in an amount equivalent to that of 6 inch band treatments in 22 inch rows.

Yields of beans in the field, dry weight of the beans in the greenhouse, observations of effects, injury ratings, microscopic examination, and weed counts were used to evaluate the effects of oil spray applications.

The following experimental oils gave good weed control with little injury to the bean stems:

a. LS-0133 (90% mineral spirits, 10% Indocene 70)
b. LS-0150 (90% mineral spirits, 10% Indosolvent 2)
c. LS-0152 (85% mineral spirits, 15% Indocene 70)
d. LS-0155 (40% mineral spirits, 40% Alkylate, 20% Indosolvent 2)
e. LS-0237 (Heavy naphtha)

No significant reduction in yield occurred following oil application in the field and about 75 per cent weed control was obtained. Grasses were controlled better than broadleaved weeds. Ragweed (Ambrosia artemisiifolia L.) appeared to be resistant to oil spray.

The typical oil injury on beans was characterized by a wilting of the plant similar to that of a plant in drought conditions. The treated area was water soaked in appearance and, later, turned a dark brown. Microscopic examinations of bean stems treated with oil revealed that toxic oils may cause a breakdown of cells in the epidermis, cortex, phleem and vascular cambium, and initiate, in cells adjacent to the injured cells, a reversion to meristematic activity.

Ten gallons per acre of a herbicidal oil gave better weed control than 5 gallons per acre and less injury to bean plants than 20 gallons per acre. A repeat application of a herbicidal oil gave slightly more injury but did not decrease the yield. The resistance of bean stems to oils appeared to decrease with age. However, for ease and accuracy of mechanical application, and for weed control, the best stage for spraying was the first trifoliate leaf stage. Applications of a herbicidal oil in a 60° F. temperature gave less injury than applications in 70 and 80° F. temperatures. Application of a herbicidal oil to bean stems with closed stomata gave less injury than when applied to bean stems with open stomata.

The types of beans arranged in order of decreasing oil resistance are: Field beans, soybeans, wax beans, green beans and lima beans. 90 pages. $2.00.

CHEMISTRY, GENERAL

THE INFRARED SPECTRA OF INORGANIC COORDINATION COMPOUNDS

(L. C. Card No. Mic 58-2349)

Salem Thomas Clark, Ph.D.
University of Missouri, 1958

Supervisor: Professor E. E. Pickett

Thirty-seven coordination compounds were prepared from the ligands ethylenediamine, ethanolamine, diethylenetriamine and N-ethylaminoethanolamine with the metals cadmium, zinc, manganese, nickel, copper and cobalt. It was found that the ratio of ligand to metal in the solid complexes could be varied in some cases by varying the stoichiometric amounts of the reactants.

The infrared absorption spectra of the liquid ligands and their hydrochlorides were recorded in the 2-15 micron region. The infrared absorption spectra of all of the solid complexes prepared were recorded in the 2-15 micron region using the KBr pellet technique. A KBr pellet die was described that produces a KBr pellet suitable for use with the micro attachment for the Beckman IR-2A Infrared Spectrophotometer. The spectra of approximately half of the complexes were recorded in the 15-25 micron region. The spectra of the ligands, the ligand hydrochlorides and the complexes were reproduced in the 2-15 micron region. The spectra were also reproduced in the form of line graphs from 2-25 microns.

Several important differences were found in the spectra of complexes formed from a given ligand with different metals. The nitrogen-hydrogen stretching absorption bands shifted to lower frequency and remained fairly constant in intensity with increased strength of the metal-nitrogen bond. The carbon-hydrogen stretching absorption bands shifted to higher frequency with increased strength of the metal-nitrogen bond. The integrated molar absorbance of the carbon-hydrogen stretching absorption bands was shown to be nearly in direct proportion to the logarithm of the stability constant of the ethylenediamine complexes. With increased stability it was found that the bands due to bending motion of the CH_2 and NH_2 groups generally were shifted to higher frequency and decreased in intensity. However, this was not true for the absorption bands at 6.2 and 6.8 microns assigned respectively to NH_2 and CH_2 scissoring vibrations. No correlation was found between the position of these bands and the stability of the complex. Changes in electron distribution, changes in hybridization of orbitals, and steric factors were discussed as possible causes for the above changes.

The effect of the anion on the spectrum of a coordination compound was discussed and found to be small except in the cases in which the molecule could be expected to contain an uncoordinated OH group.

Absorption bands were found in the 16-20 micron region of the spectra of all the complexes which correspond to absorption bands previously assigned to the metal-nitrogen rocking vibration. The position of these bands was found to be the most characteristic feature of the different metals present in the complexes.

An attempt was made to correlate the observed spectra with the presence of an uncoordinated OH group. This was largely unsuccessful due to the inherently weak coordinate co-valent bond formed by the OH group and possibly other factors such as lattice forces and hydrogen-bonding to the anion. The possibility of a complex of the type $[Ni(NH_2CH_2-CH_2OH)_4]Br_2$ having the OH groups strongly bonded without exceeding the coordination number of six for nickel was discussed.

A definite correlation was found between the spectra and the type of ring structure in the complex. All of the complexes investigated contained 5-membered rings and absorbed at approximately 11.2 microns. The complexes of ethylenediamine which contain 5-membered rings with one member in common were found to have the same absorption pattern in the 9.5-13 micron region as the analogous spirononane. The complexes of diethylenetriamine which contain two 5-membered rings with two members in common were found to have the same absorption pattern in the 9.5-13 micron region as the analogous bicyclooctane.

148 pages. $2.00.

SPARK-IN-FLAME SPECTROSCOPY

(L. C. Card No. Mic 58-2451)

William Albert Straub, Ph.D.
Cornell University, 1958

A spectroscopic source consisting of a spark discharge within a flame has been studied as an analytical tool for the analysis of dilute solutions. The unit consists of an oxy-hydrogen flame and a high voltage controlled spark discharge. The sample is aspirated into the flame and the spark gap is focused on the entrance slit of a monochromator. There are several advantages to be gained in combining the spark and flame which are not realized for each separately. The plasma of conducting material being constantly introduced into the spark gap produces a more regular discharge which improves the reproducibility of the spark. In addition, the flame disperses and vaporizes the sample and produces initial ionization of the added sample. The spark-in-flame source has the convenience and precision of flame spectroscopy combined with the sensitivity of a high voltage spark. A photomultiplier detector was used and its output was amplified and passed through a filter circuit timed to the spark frequency. The spectra were recorded on a strip chart recorder.

Experimental parameters which would be expected to affect the sensitivity and precision of the method were investigated. A variety of electrode materials were tried and silver exhibited the best reproducibility and sensitivity.

The effects of electrode separation, gas flow and fuel mixture were studied.

Elements which are not usually detectable in flame spectroscopy were easily analyzed at low concentration levels with the proposed source. For example, cadmium and zinc had sensitivities of less than 0.1 ppm while the titanium and vanadium sensitivities were 0.5-1 ppm. Reproducibility was of the order of 2-3%. The effect of interfering ions was also studied. 113 pages. $2.00.

CHEMISTRY, BIOLOGICAL

SOME PHYSIOLOGICAL EFFECTS OF GROWTH HORMONE, GLUCOCORTICOIDS, ADRENO-CORTICOTROPIC HORMONE AND INSULIN ON DAIRY COWS

(L. C. Card No. Mic 58-2210)

Anthony Chi-Wu Chung, Ph.D.
University of Maryland, 1958

Supervisor: Professor J. C. Shaw

Single intramuscular injections of various amounts of cortisone-acetate, hydrocortisone acetate, hydrocortisone alcohol, 9α-fluorohydrocortisone and prednisone were given to 28 lactating cows. The relative hyperglycemic effect of these glucocorticoids was found to be in decreasing order of potency, 9α-fluorohydrocortisone, prednisone, hydrocortisone alcohol, hydrocortisone acetate and cortisone-acetate. The relative depressing effect on milk production followed the same order. Depression in milk production was evident for as long as two weeks when large single dosages were administered. Repeated injections of large dosages depressed milk production for as long as four weeks after the cessation of injection.

Successive daily injections of growth hormone increased milk and milk fat production and at the same time induced a decrease in blood plasma ester cholesterol and an increase in the lipid fraction of neutral fat and free acids. Total blood plasma lipids remained relatively constant.

Repeated daily injections of adreno-corticotropic hormone produced a decrease in milk and milk fat production and an increase in the saturation of the milk fat. On the other hand, daily injections of growth hormone resulted in a marked increase in milk fat production and a decrease in the saturation of the milk fat. The molar per cent of butyric acid in the milk fat did not deviate from normal in either case.

Six cows received cortisone-acetate, insulin and growth hormone alone and in various combinations. Both insulin and cortisone-acetate were found to depress milk production when given alone or together. The galactopoietic effect of growth hormone was inhibited to some extent when insulin alone or in combination with cortisone-acetate was administered in addition to growth hormone.

The blood plasma sodium and potassium of eight cows during the periods immediately preceding and following parturition remained relatively constant. Single injections of small amounts of 9-αfluorohydrocortisone caused a decrease in blood plasma potassium within 24 hours but no change in blood plasma sodium. Repeated daily injections of large doses of adreno-corticotropic hormone, hydrocortisone acetate or insulin, prepartum, did not alter materially the blood plasma sodium or potassium of cows during either the injection period or the period immediately postpartum.

Successive daily injections of hydrocortisone acetate during the prepartal period maintained blood glucose at high levels and circulating eosinophils at low levels. Similar injections of adreno-corticotropic hormone evoked similar changes which were of short duration only.

During the postpartal period the cow was found to be more sensitive to the hypoglycemic effect of insulin than during the prepartal period. Successive daily injections of cows with adreno-corticotropic hormone, hydrocortisone acetate or insulin, prepartum, did not have any marked effect on the postpartal blood glucose levels.

78 pages. $2.00.

BIOCYTINASE

(L. C. Card No. Mic 58-2436)

Richard Thomas Darragh, Ph.D.
Cornell University, 1958

An extensive study of biocytinase was conducted in order to obtain more information about this enzyme which was detected and reported on briefly in 1954. The enzyme capable of catalyzing the hydrolysis of biocytin to biotin and lysine was detected in human blood. According to Wright et al. Proc. Soc. Expt. Biol. and Med., 86, 335-337 (1954) (I), it is present in both blood plasma and the formed elements, has an optimum pH range of 6.0 to 6.7 and requires a reducing agent for consistent maximum hydrolysis. The method of Wright et al. (I) was used for the enzymatic assay and that of Wright and Skeggs, Proc. Soc. Expt. Biol. and Med., 56, 95-98 (1944) for the biotin determination. Our observations are summarized here.

The temperature optimum of the enzyme ranges from 30°C to approximately 45°C. when blood is used as the enzyme source. Two-thirds of the activity obtained at optimum temperature is retained within a 30° range, namely from 20° to 50°C.

No change in enzymatic activity is detected when the enzyme is assayed in sodium phosphate buffers of molarities ranging from 0.1 to 0.5. The enzyme in whole blood and serum is rather stable to dialysis. When serum is dried at room temperature no change in enzymatic activity occurs. No reduction of biocytinase activity was detected after blood samples were heated at 60°C for 5 minutes. Blood and serum, diluted as well as undiluted, can be kept for at least 24 hours at room temperature without loss of activity. A 24-week stability study indicated that the enzyme in sheep blood kept under refrigeration loses activity rather sharply for the first 10 to 12 weeks then tends to level off for the following 12 to 14 weeks.

Biocytinase can be exposed to sub optimum pH conditions and still regain complete activity when returned to its optimum pH range. Reactivation of blood or serum biocytinase subjected to a high temperature-short time treatment was not obtained.

The enzyme was found to be present in sheep, dog, rat, cow, steer, guinea pig, hamster and chicken blood in decreasing order of activity. The enxyme is not present in detectable amounts in rabbit or horse blood.

A component containing slight biocytinase activity has been separated from the albumin of serum as a leading edge by paper electrophoresis. A pH 4.9 acetate buffer of low ionic strength was used. The separation has been accomplished by a one-step procedure directly from serum. Electrophoretically homogeneous (pH 8.6) albumin has been resolved into several components by the same paper electrophoresis technique.

Biocytinase activity determined in the acid range is not affected when sodium phosphate buffer is replaced by potassium phosphate, or acetate buffers. In the alkaline range, tris, and potassium phosphate buffers are as effective as sodium phosphate. Borate buffer enhances biocytinase activity while veronal buffer inhibits the enzyme.

It appears that coeliac patients and individuals related to them have lower blood biocytinase levels than normal individuals. More blood samples need to be analyzed, however, before this tentative general statement can be confirmed.

Biocytin synthesis is not obtained when biotin, lysine, and serum are incubated together.

There exists, in human blood, one or more enzymes capable of catalyzing the hydrolysis of biotinyl-β alanine, biocytin, biotinamide, biotinyl-p-amino benzoic acid, and biotinylsulfanilamide. The substrates are presented in order of increasing susceptibility to enzymatic hydrolysis. Whether or not the hydrolysis of these biotin analogs is catalyzed by more than one enzyme of blood was not determined. No enzyme capable of catalyzing the release of biotin from biotinyl-L-aspartic acid ethyl ester seems to exist in human blood. 100 pages. $2.00.

SOME ASPECTS OF PYRUVATE METABOLISM

(L. C. Card No. Mic 58-2460)

Aaron David Freedman, Ph.D.
Columbia University, 1958

Both carbohydrates and fats are oxidized in the tricarboxylic acid cycle after conversion to a two carbon compound. These two carbon compounds are oxidized only after condensation with oxalacetic acid which can be derived from carbohydrate and certain amino acids but not from fat. In order to determine the source of the two carbon oxidizable compound, and how this is influenced by the nutritional status of the animal in liver and tumor tissue of the rat, the following experiment was performed.

DL alanine-$2C^{14}$ was injected intraperitoneally into fasted and fed rats with and without the Murphy-Sturm lymphosarcoma. One hour later, the animals were killed, livers and tumors removed, and L-glutamic acid isolated, degraded, and the radioactivity of each carbon atom measured.

Alanine is rapidly converted in mammalian tissue to pyruvic acid. Pyruvic acid can be metabolized in the tricarboxylic acid cycle either by prior oxidative decarboxylation to acetyl CoA, or by conversion to malate by CO_2 fixation. If pyruvate-$2C^{14}$ is converted to acetyl-$1C^{14}$ CoA and the latter oxidized in the tricarboxylic acid cycle, L-alpha-keto glutarate and L-glutamate will be isotopic only in carbons 1 and 5. If pyruvate is converted to a dicarboxylic acid by CO_2 fixation and the glutamate isolated, the glutamate will be radioactive in carbons 3, 2 and 1 in order of decreasing radioactivity. If the CO_2 fixed is radioactive, only carbon 1 of glutamate will be labeled. Carbon 4 will be labeled only by decarboxylation of a dicarboxylic acid labeled in the central carbons to acetyl CoA in two successive steps and by the entrance of the latter into the tricarboxylic acid cycle. Under these conditions carbon 4 will be the most heavily labeled carbon of glutamate. It is seen, therefore, that the pattern of distribution of isotopic carbon should reveal the made of entrance of pyruvate into the tricarboxylic acid cycle.

In the liver of the fasted rat, carbon 4 was virtually unlabeled and carbon 5 had less than 4% of the total glutamate activity. This indicated that there was no formation of acetyl CoA by successive decarboxylations of oxalacetic acid, and that little pyruvate was converted to acetyl CoA. Over 50% of the radioactivity was found in carbon 3, with the remaining isotope in carbons 1 and 2. In the liver of the fasting animal, therefore, pyruvate is used for dicarboxylic acid formation, and only minimally for acetyl CoA synthesis.

In the animal given glucose prior to the administration of the isotope, the essential change was a six to fifteen fold increase in the radioactivity of carbon 5 with a proportionate decrease in labeling of carbons 3 and 2. Thus in the well fed animal, pyruvate is an important precursor of acetyl CoA.

The tumors showed a similar shift in labeling pattern when the aminal was fed. The significant differences from liver were that in the tumors of fasted animals, a larger proportion of pyruvate was converted to acetyl CoA than was found in liver, and that in tumors of both fasted and fed animals there was significant radioactivity in carbon 4, indicating the synthesis of acetyl CoA from oxalacetate.

It is concluded that in the liver of rats in the fasting state, pyruvate is used almost solely as a source of dicarboxylic acid, but when large supplies of glucose are available, conversion of pyruvate to acetyl CoA occurs readily. Tumors even in fasted animals show appreciable conversion of pyruvate to acetyl CoA, an effect heightened by glucose feeding. Tumors also demonstrate a rapid conversion of oxalacetate to acetyl CoA. 50 pages. $2.00.

PURIFICATION OF BETA-GLUCURONIDASE FROM E. COLI

(L. C. Card No. Mic 58-2217)

Florence Lazicki Lakshmanan, Ph.D.
University of Maryland, 1958

Supervisor: Dr. Fletcher P. Veitch

Beta-glucuronidase from a commercial Escherichia coli preparation was purified in a three-step procedure requiring approximately eight hours to complete. A preliminary investigation of various factors affecting the activity of the enzyme was made; these included enzyme concentration, substrate concentration, temperature and

pH and concentrations of glycine, phosphate, acetate and borate buffers. Two molecules of the substrate combined with one molecule of the enzyme, the second molecule resulting in inhibition of the enzyme. At 37° C. the Michaelis constant (K_m) of the enzyme-substrate complex, ES, was 3.8×10^{-5}; the Michaelis constant (K_2) for the complex, ES_2, was 3.5×10^{-4}.

The first step of the purification procedure was a "differential" heat denaturation of contaminating proteins during which the enzyme was protected by a strong-binding competitive inhibitor. Several organic compounds were tested for their inhibitory power on the enzyme and two, 3,5-dinitrosalicylic acid and tannic acid (m-digallic acid), were selected for determination of the type of inhibition, comparing four methods of graphical analyses. 3,5-Dinitrosalicylic acid was a simple competitive inhibitor ($K_i = 1.3 \times 10^{-3}$). Two molecules of tannic acid combined with one molecule of the enzyme in a competitive manner ($K_i = 1.0 \times 10^{-10}$). Both inhibitors protected the enzyme during heating and tannate was selected for use in further purification of the enzyme. No measurable enrichment was obtained in this step but a higher yield and a greater degree of purification resulted during subsequent fractionation with manganese chloride when the heating step was employed first.

The enzyme could be precipitated with manganese chloride and extracted from the precipitate with M/7.5 phosphate buffer (pH 7.0). This treatment effected a 12- to 16-fold increase in specific activity with approximately a 60 per cent yield. After a second addition of manganese chloride the enzyme remained in the supernatant and an over-all enrichment of 26-30-fold was obtained with an over-all yield of 50-60 per cent.

Conventional electrophoresis studies in M/50 phosphate buffer (pH 7.0) revealed only one protein component; there was complete inactivation of the enzyme during the process.

148 pages. $2.00.

THE ENZYMATIC REACTIONS OF CARBON DIOXIDE AND ASPARTIC ACID IN PURINE BIOSYNTHESIS

(L. C. Card No. Mic 58-1855)

Lewis Nelson Lukens, III, Ph.D.
University of Pennsylvania, 1958

Supervisor: John M. Buchanan

The enzymatic synthesis of 5-amino-1-ribosyl-4-imidazolecarboxamide 5'-phosphate from 5-amino-1-ribosyl-imidazole 5'-phosphate, ATP, aspartic acid and carbon dioxide has been studied. This over-all reaction is one of the steps in the de novo synthesis of inosinic acid by soluble enzymes of pigeon and chicken liver. Three reactions have been found to be responsible for the conversion of 5-amino-1-ribosyl-imidazole 5'-phosphate to 5-amino-1-ribosyl-4-imidazolecarboxamide 5'-phosphate. These reactions are: 1) the formation of 5-amino-1-ribosyl-4-imidazolecarboxylic acid 5'-phosphate from 5-amino-1-ribosyl-imidazole 5'-phosphate and carbon dioxide; 2) the reaction of 5-amino-1-ribosyl-4-imidazolecarboxylic acid 5'-phosphate with aspartic acid and adenosine 5'-triphosphate to produce N-(5-amino-1-ribosyl-4-imidazolylcarbonyl)-aspartic acid 5'-phosphate, adenosine 5'-diphosphate and inorganic phosphate; and 3) the formation of 5-amino-1-ribosyl-4-imidazolecarboxamide 5'-phosphate and fumaric acid from N-(5-amino-1-ribosyl-4-imidazolylcarbonly)-aspartic acid 5'-phosphate. The isolation and properties of the two previously unreported ribotides, 5-amino-1-ribosyl-4-imidazolecarboxylic acid 5'-phosphate and N-(5-amino-1-ribosyl-4-imidazolylcarbonyl)-aspartic acid 5'-phosphate, are described.

118 pages. $2.00.

THE PARTICIPATION OF ADENOSINE TRIPHOSPHATE IN PROTEIN SYNTHESIS

(L. C. Card No. Mic 58-2163)

Melvin Philip Stulberg, Ph.D.
University of Minnesota, 1958

Adviser: P. D. Boyer

The studies represented in this thesis were undertaken to further elucidate the mechanism of protein synthesis. The primary objective was to determine, by use of the isotope O^{18}, the fate of amino acid carboxyl oxygens during net protein synthesis by Leuconostoc mesenteroides P-60.

Preliminary work established and experimentally tested conditions necessary for the initiation of subsequent more refined studies. Upon growth of the organism in H_2O^{18} (1.27 atom % excess), O^{18} was incorporated into extracellular phosphate (iP_e) to an extent of .06 atom % excess O^{18}. Also, growth in the presence of O^{18} labeled iP_e (0.278 atom % excess O^{18}) showed a decrease in the O^{18} level of iP_e after growth to 0.175 atom % excess O^{18}. These exchanges or incorporations amounted to a turnover of 0.7 to 3 micromoles of iP_e per micromole of amino acid incorporated into protein. Subsequent experiments showed that these apparent exchanges would not lead to loss of amino acid carboxyl oxygen to water; no O^{18} from amino acids appeared in iP_e during growth, and also all O^{18} lost from the amino acids was accounted for in fractions other than iP_e. Therefore, the observed H_2O oxygen incorporation into iP_e and loss of O^{18} label from iP_e appears to be a result of a reaction where ATP is hydrolyzed with the incorporation of a H_2O oxygen into iP_e. Such a reaction could be represented by active transport reactions where ATP is hydrolyzed in the region of the cell surface.

The preparation of O^{18} labeled amino acids was accomplished by acid hydrolysis of casein in the presence of H_2O^{18} followed by purification and concentration. The O^{18} content of these amino acids was determined by methods of back equilibration into H_2O and equilibration of this water with CO_2. Bacterial protein was analyzed for O^{18} content by similar procedures. Phosphate fractions were isolated as KH_2PO_4 and analyzed for O^{18} by an H_2O-CO_2 oxygen exchange catalyzed by hot platinum. Lactic acid produced by the organism was isolated as the silver salt and decarboxylated. The CO_2 produced by all these procedures was collected and analyzed for O^{18} content by mass spectrometry.

After growth of the organism on O^{18} labeled amino acids, fractions were isolated and analyzed for their content of O^{18}. Results of these studies established the following: 1. During the course of amino acid uptake,

activation and incorporation into protein, little or no reactions occur whereby the oxygen of the carboxyl group of amino acids is replaced by an oxygen from any other source. About eighty percent of the amino acid O^{18} level was found in the peptide carbonyl oxygen. 2. At least one oxygen from each amino acid incorporated into protein appears in the carboxyl group of lactic acid formed from glucose fermentation. In all probability, this occurs by transfer of the oxygen to a phosphate moiety and then through a sequence of reactions to lactate. The O^{18} lost from the incorporated amino acids was, within reasonable experimental error, quantitatively accounted for by its appearance in lactic acid. 3. Little, if any, O^{18} from amino acids is found in any intra- or extracellular phosphate fraction. Therefore, any small phosphate pool which does become labeled with O^{18} does not intermix with other phosphate fractions, and the amino acid activation reactions are similarly highly localized in the cell.

Studies with a highly purified tryptophan activating enzyme established that the activation of the amino acid coupled to the cleavage of ATP involved the transfer of one carboxyl oxygen from tryptophan to phosphate of adenosine monophosphate (AMP). This result points strongly to the intermediate formation of an anhydride-type compound, probably an amino acyl adenylate, between AMP and the amino acid. 91 pages. $2.00.

AMMONIA FIXATION BY SOIL ORGANIC MATTER: SOME RELATIONSHIPS BETWEEN FORMS OF NITROGEN AND COMPONENTS OF SOIL ORGANIC MATTER

(L. C. Card No. Mic 58-2452)

Aurora Tan Violanda, Ph.D.
Cornell University, 1958

A review was presented of the work to the present time concerning ammonia fixation by organic matter and peat materials. This research was designed with the following objectives in mind. First, to determine the nature of the substances reacting with ammonia. Second, to determine the effect of ammoniation on the solubility and acid-content of the materials used. Third, to try to evaluate the availability of the nitrogen fixed by ammoniation.

Non-ammoniated and ammoniated samples of Anderson and Dryer muck soils were hydrogen-saturated and additional samples were barium-saturated. Extracts were prepared from the hydrogen-saturated peat meaterials by extraction with phosphate buffer (pH 7) and centrifugation to separate the extracts from the residues. The muck extracts were analyzed for amino nitrogen, total nitrogen and organic matter. Column electrophoresis runs were made on the four muck extracts to separate components and determine mobilities, using sucrose as reference material. The fractions collected were analyzed for color, organic matter, polysaccharide and total nitrogen. Nitrification experiments using a modified Quastel perfusion apparatus were made on the four peat materials to measure the availability of the nitrogen fixed by ammoniation. Hydrolysis experiments were made on samples of barium-saturated, non-ammoniated and ammoniated Anderson and Dryer muck soils. The acid hydrolysates were analyzed for ammonium and total nitrogen contents, while the washed residues were analyzed for total nitrogen.

Ammoniation increased the nitrogen contents of the muck soils. This was accompanied by an increase in solubility of organic matter and color in both aqueous and phosphate buffer solutions. The less oxidized Anderson muck fixed more ammonia nitrogen per gram of soil than the more oxidized Dryer muck. Also, a larger proportion of the fixed ammonia nitrogen in Dryer muck was extractable by phosphate buffer. Column electrophoresis results showed that the nitrogen peak coincided with the peaks for color and organic matter. Nitrogen was shown to be uniformly distributed in the organic matter. Ammoniation increased the concentration of the high-mobility polysaccharide component with an accompanying decrease of the same magnitude of the low-mobility polysaccharide component. Total nitrogen in muck soils and in the muck extracts, organic matter, color and high-mobility polysaccharide component in the extracts, ammonium and total nitrogen in acid hydrolysates of the peat material were all of the same rank in the following series: non-ammoniated Anderson muck < ammoniated Anderson muck < non-ammoniated Dryer muck < ammoniated Dryer muck. Only amino nitrogen showed a good correlation with nitrification results, both of which were related as follows: non-ammoniated Anderson muck < non-ammoniated Dryer muck < ammoniated Anderson muck < ammoniated Dryer muck. Nitrification or rate of conversion of fixed nitrogen to nitrate nitrogen seemed to be directly related to primary amino nitrogen and solubility of organic matter.

101 pages. $2.00.

CHANGES IN THE APPARENT ASCORBIC ACID OF STRAWBERRIES DURING FROZEN STORAGE

(L. C. Card No. Mic 58-2373)

Chuan-huan Wu, Ph.D.
Michigan State University, 1955

Changes in the apparent ascorbic acid of strawberries of the Catskill and Robinson varieties during frozen storage were studied.

Concentrations of total apparent ascorbic acid, reduced ascorbic acid, dehydroascorbic acid, 2,3-diketogulonic acid, reductones, reductic acid, total ascorbic acid, reducing sugar and total solids were determined in strawberries which had been frozen for 30 hours and in strawberries during frozen storage at -27 to -31 degrees Centigrade. Analyses were made at monthly intervals for a period of ten months in strawberries of the Catskill variety and six months in strawberries of the Robinson variety. The concentrations of the various components in the strawberries which had been frozen for 30 hours were employed as base line to study the changes of these components during frozen storage.

There was little change in the total apparent ascorbic acid of the strawberries during the first month of frozen storage; however, there was a marked decrease in reduced ascorbic acid and an increase in the concentrations of dehydroascorbic acid and 2,3-diketogulonic acid of the frozen strawberries during this period. Fluctuations in concentrations of the components of the strawberries of

both varieties occurred throughout the entire period of frozen storage; there was a significantly inverse relationship between the concentrations of 2,3-diketogulonic acid and total ascorbic acid of the frozen strawberries.

The influence of the changes of apparent ascorbic acid in strawberries during frozen storage on the utilization of ascorbic acid in strawberries was studied with six healthy young women as subjects. Subjects were given 75 milligrams crystalline reduced ascorbic acid as a supplement to their customary diet for seven days before each test period. Test doses given at four test periods were (a) 200 grams strawberries of Catskill variety, frozen for 30 hours; (b) an amount of crystalline reduced ascorbic acid equivalent to the amount of total apparent ascorbic acid provided in the test dose of 200 grams of strawberries; (c) an equivalent amount of dehydroascorbic acid in the form of orange juice treated with activated charcoal, and (d) 250 grams of strawberries, frozen and stored for four months. Blood samples were taken before and at hourly intervals after the test doses for a five-hour period. Urine was collected for a one-hour period preceding and for a five-hour period following each test dose. The blood serum was analyzed for reduced and total apparent ascorbic acid; urine was analyzed for reduced ascorbic acid.

There was not a statistically significant difference among the maximum concentrations of ascorbic acid in the blood serum following the test doses, nor in the urinary excretions of ascorbic acid after the test doses. When the total apparent ascorbic acid of the strawberries which had been held in frozen storage was corrected for the amount of 2,3-diketogulonic acid present in the berries, the total available ascorbic acid appeared to be as well utilized as that of the strawberries which had been frozen for only 30 hours. 185 pages. $2.45.

CHEMISTRY, INORGANIC

THE SEPARATION AND DETERMINATION OF RUBIDIUM AND CESIUM BASED ON ION EXCHANGE

(L. C. Card No. Mic 58-2413)

Edgar William Albaugh, Ph.D.
Michigan State University, 1954

The conditions for the ion exchange separation of rubidium and cesium have been established.

A preparative procedure for high purity rubidium chloride using an ion exchange separation has been developed. It consists essentially of eluting one gram quantities of commercial rubidium chloride from a column containing a resin bed 81 cm. high and 3.8 cm. in diameter of 200-400 mesh Dowex 50 with 0.7 normal hydrochloric acid at a flow rate of 4.4 ml. per minute. The rubidium chloride is recovered from the proper volume of eluate by evaporation and precipitation with hydrogen chloride. Flamephotometric analysis of the purified product shows the rubidium chloride content to be approximately 99.7 per cent.

Cesium chloride was prepared from pollucite by treating the mineral with a mixture of hydrofluoric and sulfuric acids and then recrystallizing the resulting cesium alum. The sodium and potassium content appears to remain constant after several recrystallizations. For final purification the cesium alum was converted to the iododichloride and recrystallized. The purified product was analyzed flamephotometrically and the cesium chloride content is approximately 99.7 per cent.

Flamephotometric determination of rubidium and cesium is described. The flame intensities at 780 and 852 mu were measured for the estimation of rubidium and cesium respectively. The enhancement effect of large amounts of rubidium on other alkalies is demonstrated and methods proposed for their approximation in the purified rubidium chloride.

A method for the quantitative determination of rubidium and cesium based on ion exchange has been developed. The procedure involves separating samples of the mixed chlorides by elution from a column containing a resin bed of Dowex 50, minus 400 mesh, 87 cm. high and 2.2 cm. in diameter with 0.7 normal hydrochloric acid at a flow rate of 2.7 ml. per minute. After elution the appropriate fractions of effluent were evaporated to dryness and the alkali metal content determined by weighing the ignited rubidium and cesium sulfates. A small blank correction, obtained by evaporating portions of eluate and weighing the ignited sulfate residues, was found necessary. An accuracy of two per cent was obtained for 100-200 mg. samples of the chlorides when rubidium and cesium are present in approximately equal proportions. 84 pages. $2.00.

PART ONE: THE PYROLYSIS OF DECABORANE. PART TWO: THE REACTIONS OF DECABORANE WITH DIMETHYLAMINE.

(L. C. Card No. Mic 58-2441)

Steven Joseph Fitch, Ph.D.
Cornell University, 1958

Part One: Icosahedra of boron atoms are known to exist in elementary boron and in boron carbide, but the corresponding icosahedral hydride $B_{12}H_{12}$ is not known. However, a slightly distorted icosahedron of boron atoms which lacks two boron atoms on adjacent vertices is known to exist in decaborane, $B_{10}H_{14}$. Various data suggested that it might be possible to form volatile $B_{12}H_{12}$ molecules by pyrolysis of decaborane under conditions which would permit the resulting hydrogen to escape from the pyrolysis zone by diffusion through a palladium tube. Accordingly, four such pyrolyses were performed, and the rate of hydrogen evolution was observed. The pyrolysis was a first order process which produced polymeric residues of approximate composition $BH_{0.6}$. The solid residues were formed in part in the gas phase.

No volatile species other than hydrogen and unreacted $B_{10}H_{14}$ was isolated.

Part Two: Decaborane was found to react with dimethylamine under various conditions to form either aminates (molecular addition compounds) or aminolytic products.

The slightly volatile aminate $Me_2HN{\cdot}B_{10}H_{14}$ was formed by (1) the reaction of nitrogen-diluted dimethylamine with dilute solutions of decaborane in hydrocarbon solvents, (2) the reaction of gaseous dimethylamine with decaborane

vapors carried by a nitrogen stream, (3) incomplete reaction of liquid dimethylamine and solid decaborane at -78° followed by removal of excess dimethylamine and separation of the $Me_2HN \cdot B_{10}H_{14}$ from higher aminates by sublimation at higher temperatures, and (4) the decomposition at 65° of $(Me_2HN)_2 \cdot B_{10}H_{14}$ with simultaneous separation by sublimation of $Me_2HN \cdot B_{10}H_{14}$ from the unreacted $(Me_2HN)_2 \cdot B_{10}H_{14}$ and concurrently formed aminolytic products.

The aminate $(Me_2HN)_2 \cdot B_{10}H_{14}$ was formed by (1) the reaction of gaseous dimethylamine with decaborane in a hydrocarbon solvent, (2) the reaction of liquid dimethylamine with solid decaborane, and (3) the reaction of gaseous dimethylamine with decaborane vapors carried in a nitrogen stream.

The aminate $(Me_2HN)_3 \cdot B_{10}H_{14}$ was formed by (1) the reaction of gaseous dimethylamine with decaborane in a hydrocarbon solvent, and (2) reaction of liquid dimethylamine with solid decaborane.

Temperature-composition studies verified the compositions of the aminates and provided some evidence for the existence of $(Me_2HN)_4 \cdot B_{10}H_{14}$ and $(Me_2HN)_5 \cdot B_{10}H_{14}$.

The three lower aminates are characterized by their X-ray powder diffraction patterns, by their ability to yield decaborane upon removal of dimethylamine by reaction with aqueous acid, by their insolubility in solvents which do not react with them, by definite decomposition pressures (except for $Me_2HN \cdot B_{10}H_{14}$) for which some limits have been assigned, and by their explosive reaction with nitric acid. They all react slowly with air, and the aminates higher than $(Me_2HN)_2 \cdot B_{10}H_{14}$ are unstable at room temperature, either losing dimethylamine or undergoing aminolytic reactions.

Aminolytic reactions, possibly involving the loss of a BH_3 group from $B_{10}H_{14}$ to form $Me_2HN \cdot BH_3$ plus an amine-stabilized B_9 residue, have been observed at temperatures from 0° to 65°, depending on the dimethylamine concentration. The resulting mixture of products was not well characterized, but upon acid treatment the mixture lost hydrogen to form a material which appeared to be a dimethylamide of a B_9 residue. The dimethylamide was soluble in organic solvents and slightly volatile, and it gave a definite X-ray diffraction pattern.

The material proved to be unstable and difficult to separate from its impurities, and it could not be definitely identified. 124 pages. $2.00.

SOME ASPECTS OF THE DISCHARGE REACTION OF ELECTROLYTIC MANGANESE DIOXIDE ELECTRODES

(L. C. Card No. Mic 58-2295)

Ahmad Sam, Ph.D.
Duke University, 1958

Supervisor: W. C. Vosburgh

A survey was made of the literature concerning the crystalline forms of manganese dioxide and their utility as dry cell reactants, and of lower oxides of manganese as the end products in the discharge of dry cells.

Lower oxides of manganese of the compositions $MnO_{1.33-1.88}$ in the hydrated form were made by oxidation of $MnSO_4$ solution with $K_2S_2O_8$ at different pH values. The potentials of electrodes made of the oxides thus prepared in solutions of 1.0 M $(NH_4)_2SO_4$ buffered at pH values 4.7-8.0 with pyridine or NH_3 were measured. They were found quite reproducible if one part of carbon was mixed with four parts of the oxide. A linear pH-potential relationship was established for MnOOH with 20% carbon by the above method.

The disproportionation of lower hydrated oxides of manganese into MnO_2 and Mn^{++} according to the reaction

$$2MnOOH + 2H^+ \rightleftharpoons MnO_2 + Mn^{++} + 2H_2O$$

in the electrolyte solutions of 2.0 M $(NH_4)_2SO_4$ buffered at pH values 4.7-8.0 was studied. A straight line relationship between log (Mn^{++}) and pH of the electrolyte was established for the oxides $MnO_{1.33-1.88}$. The relation is not for equilibrium, but for a reaction time of 3 hours.

A number of electrolytic MnO_2 electrodes were made by the electrodeposition from acidic solutions of $MnSO_4$ at 80°C and 90°C on graphite rods. The electrodes prepared in the absence of NH_4^+ ions were designated as γ-variety and those prepared in the presence of NH_4^+ as α-variety. The electrodes thus made were discharged in solutions of 1.0 M $(NH_4)_2SO_4$ at pH values 7.5 and 8.0 with 1.0-4.0 ma per electrode at 25°C. The following characteristics concerning the discharge of the electrodeposited MnO_2 electrodes were obtained.

1. The equilibrium potentials of the electrodes were 0.47-0.52 volt at pH 7.5 and 0.42-0.51 volt at pH 8.0.
2. The discharge curve was found to be similar in shape to the titration curve of an oxidation-reduction reaction in an electrolyte solution. It was found to be different for the two different varieties, α and γ.
3. The discharge capacity of an electrode, i.e., the ma-min of electricity to discharge the electrode, was found to be greater for smaller current densities. It was greater for α- than for γ-electrodes.
4. It was found that Mn^{++} develops in the electrolyte solution as the result of discharge. The first measurable appearance of Mn^{++} in the discharge of γ-electrodes was after 100 ma-min and in the discharge of α-electrodes after 60 ma-min. More Mn^{++} is dissolved in the solution for α- than for γ-MnO_2 at any stage of discharge.
5. The composition of a discharged electrode after it was well washed with an electrolyte was found to be $MnO_{1.9}$ for both varieties. Such washing removes considerable Mn^{++} from the discharged electrode.
6. Some discharged electrodes were charged again by reversing the current in the electrolyte. The charge capacity was less than the discharge capacity, but the potential of charge was higher than the equilibrium potential before discharge.
7. The conclusion was made that the discharge of the MnO_2 electrode is a two step reaction, taking place on the surface exposed to the solution, with some inward diffusion of the reduction product. The inward diffusion is more important for γ-MnO_2 than for α-MnO_2.

Some suggestions for future work on the study of the discharge characteristics of the MnO_2 electrodes were made. 127 pages. $2.00.

CHEMISTRY, ORGANIC

SYNTHESIS OF ORGANOSILICON BRIDGEHEAD COMPOUNDS AND STEREOCHEMISTRY OF DISPLACEMENT ON THE SILICON ATOM

(L. C. Card No. Mic 58-2257)

Ovell Francis Bennett, Ph.D.
The Pennsylvania State University, 1958

Substituents such as halogen and hydroxyl when located on a bridgehead carbon atom of the bicyclo[2·2·1]heptane system have been shown to be remarkably inert toward reagents which are commonly used for displacement reactions at a carbon atom. An accepted theory explains this inertness in terms of the cage-like structure of the bicyclic system and further, provides an insight into the geometrical conditions necessary for bimolecular nucleophilic substitution on the carbon atom.

Since the stereochemical requirements for substitution at a silicon atom were unknown, it was thought that the synthesis of a bicyclic compound containing a silicon atom at the bridgehead position, such as 1-silabicyclo-[2·2·1]heptane, and a study of the reactivity of this and similar compounds, would be beneficial in helping to elucidate the process by which substitution occurs at the silicon atom.

Accordingly, a synthetic route leading to the preparation of the first bicyclic compounds containing a silicon atom at a bridgehead position was planned, investigated, and carried through to completion. The synthesis leading to 1-chloro-1-silabicyclo[2·2·1]heptane (I) involved the preparation of 4-trichlorosilylmethyltetrahydropyran (II), ring-opening of II in the absence of water to give 1,5-dichloro-3-trichlorosilylmethylpentane (III), and finally conversion of III to I. This synthetic route was also adapted to the preparation of 1-chloro-1-silabicyclo[2·2·2]-octane (IV). From compounds I and IV, 1-silabicyclo-[2·2·1]heptane (V) and 1-silabicyclo[2·2·2]octane (VI) were prepared.

Quantitative kinetic studies on V and VI have shown that the stereochemical conditions necessary for bimolecular nucleophilic displacement at the silicon atom are different from those required in carbon chemistry and further, this study has indicated that the nature of these geometrical requirements, in the ideal case, can be as follows:

1. The entering nucleophilic species is not required to attack the face of the silicon atom opposite the vertex to which the leaving group is attached, but may approach the silicon atom at an angle near 90^0 or 120^0 to the leaving group.

2. An inversion of configuration is not necessary for bimolecular nucleophilic displacement reactions to take place on the silicon atom. 97 pages. $2.00.

THE INTERACTION OF ALUMINUM AND GALLIUM BROMIDES WITH AROMATICS

(Publication No. 21,274)

Sang Up Choi, Ph.D.
Purdue University, 1957

Major Professor: Herbert C. Brown

The vapor pressure-composition phase studies have been carried out on the aluminum and gallium bromides (M_2Br_6)-aromatic hydrocarbon (ArH) systems, using a new experimental technique for the accurate measurement of low vapor pressures of aromatics. The results indicate the existence of the following solid complexes at 0^0: $ArH.Al_2Br_6$ (ArH: benzene, toluene, p-, o- and m-xylenes and mesitylene), $ArH.AlBr_3$ and $ArH.Ga_2Br_6$ (ArH: m-xylene and mesitylene), and $ArH.GaBr_3$ (ArH: mesitylene). These complexes are presumed to be π-complexes; π-electrons in the aromatic nuclei are utilized for the formation of the complexes. The order of increasing stability of the complexes has been established as follows:

Benzene < toluene < m-xylene < mesitylene.
Gallium bromide < aluminum bromide.

The molecular weight determination by the vapor pressure and freezing point depression methods has been used for investigating the interaction of aluminum and gallium bromides with aromatics in solution. The following molecular species have been found to exist in each solution at 0 to 5^0: $ArH.Al_2Br_6$ in benzene; a mixture of $ArH.Al_2Br_6$ and $ArH.AlBr_3$ in toluene; $ArH.AlBr_3$ in m-xylene and mesitylene; Ga_2Br_6 in benzene and toluene; $ArH.Ga_2Br_6$ in m-xylene; and $ArH.GaBr_3$ in mesitylene. These results can be accounted for in terms of the following equilibria:

$$M_2Br_6 + ArH \rightleftharpoons ArH.M_2Br_6$$
$$ArH.M_2Br_6 + ArH \rightleftharpoons 2\,ArH.MBr_3.$$

The above equilibria are shifted to the right with increasing basicity of the aromatics, with increasing acidity of the metal bromides, and with decreasing temperature of the solutions. The order of increasing interaction between aluminum or gallium bromides and aromatics in solution is the same as that for the corresponding solid complexes.

The aluminum and gallium bromides-halobenzenes (PhX) systems have also been investigated by the molecular weight determination. The results indicate the existence of the following molecular species in each solution: $PhX.Al_2Br_6$ in fluoro-, chloro-, o-dichloro- and 1,2,4-trichlorobenzenes; $PhX.AlBr_3$ in bromobenzene; Ga_2Br_6 in fluoro- and chlorobenzenes; $PhX.Ga_2Br_6$ in bromobenzene; and $PhX.GaBr_3$ in iodobenzene. These results are accounted for in terms of the following equilibria, as was considered in the aluminum and gallium bromides-aromatic systems:

$$M_2Br_6 + PhX \rightleftharpoons PhX.M_2Br_6$$
$$PhX.M_2Br_6 + PhX \rightleftharpoons 2\,PhX.MBr_3.$$

These addition compounds are presumed to form by sharing the outer electrons of a halogen atom of the halobenzene with an aluminum or gallium atom. The order of increasing interaction of aluminum and gallium bromides with halobenzenes has been established as follows:

Fluoro-, chloro- < bromo- < iodobenzene.
Gallium bromide < aluminum bromide.

From the results of the molecular weight determination by the freezing point depression method, it is concluded that aluminum chloride forms an addition compound, $C_6H_5NO_2.AlCl_3$, with nitrobenzene, but benzoyl chloride does not. A value of 6.3 ± 0.7 has been obtained for the equilibrium constant at 5.5^0 for the following reaction:

$$C_6H_5COCl + C_6H_5NO_2.AlCl_3 \rightleftharpoons C_6H_5COCl.AlCl_3 + C_6H_5NO_2.$$

The addition compound of aluminum chloride with benzoyl chloride is more stable than the corresponding addition compound with nitrobenzene; benzoyl chloride is more basic than nitrobenzene. 283 pages. $3.65. Mic 58-5036

THE SYNTHESES AND PROPERTIES OF SOME HIGH MOLECULAR WEIGHT POLYALKYLBENZENES, ALKYLPHENANTHRENES AND THEIR HYDROGENATED ANALOGS

(L. C. Card No. Mic 58-2258)

Sidney Gilbert Clark II, Ph.D.
The Pennsylvania State University, 1958

Eight previously unknown hydrocarbons in the C_{26} molecular weight range have been synthesized and purified. They are: 2-n-dodecyl-9,10-dihydrophenanthrene, 2-n-dodecylperhydrophenanthrene, 2,4,6-trimethyl-n-octadecylbenzene, 2,4,6-trimethyl-n-octadecylcyclohexane, 2,5-dimethyl-n-octadecylbenzene, 2,5-dimethyl-n-octadecylcyclohexane, 1,3-di-n-decylbenzene and 1,3-di-n-decylcyclohexane.

The methods of preparation and purification have been described and pertinent data for intermediates have been given.

The following properties have been determined and/or calculated for the new hydrocarbons: absolute and kinematic viscosities at 0^0, 20^0, 37.8^0, 60^0 and 98.9^0C; kinematic viscosity index, viscosity temperature rating between 37.8^0 and 98.9^0C; ASTM slope between 37.8^0 and 98.9^0C; instantaneous fractional change of centipoise viscosity with temperature at 37.8^0 and 98.9^0C; the constants (A, B and C) for the Antoine equation; densities at 0^0, 20^0, 37.8^0, 60^0 and 98.9^0C; melting point; heat of fusion; boiling points at 0.5, 1.0, 2.0, 5.0 and 10.0 mm. Hg; heat of vaporization; aniline point; furfural point; refractive indices at 20^0, 30^0 and 40^0C; specific and molecular refractions; molar volume; infrared spectrum. In addition, densities and viscosities have been determined at 115^0 and 135^0C in cases where the melting points were too high to permit measurements at one or more of the lower temperatures.

A brief description of the methods used, with the estimated accuracies, for the determination of the various properties has been given.

The absolute viscosities, densities and molecular volumes at 37.8^0 and 98.9^0C, viscosity temperature ratings, boiling points at 1 mm., aniline points, furfural points and melting points have been correlated with the same properties of other appropriate hydrocarbons of similar molecular weight. The conclusions drawn from these correlations are summarized below.

1. For a given molecular weight, the viscosity at 37.8^0 and 98.9^0C generally increases as the number of alkyl groups on an aromatic ring increases. The behavior of the alicyclic compounds is similar except at 98.9^0C where increasing the amount of alkylation decreases the viscosity.
2. As the number of alkyl groups on an aromatic or alicyclic ring increases, the rate of change of viscosity with temperature increases.
3. Dialkylation of an aromatic or alicyclic ring decreases the density while tri- and tetraalkylation result in an unexpected increase in density.
4. Polyalkylation appears to have little effect on the boiling points of aromatic or alicyclic compounds.
5. Polyalkylation increases the aniline points but generally decreases the furfural points of phenyl or cyclohexyl derivatives.

The disproportionation of n-decylbenzene with Friedel-Crafts type catalysts was studied to determine the effect of catalyst, catalyst concentration, temperature and reaction time on the disproportionation reaction. The conclusions drawn from the disproportionation studies are as follows.

1. The 1,3-dialkyl compound is formed in predominance over the 1,2- and 1,4-isomers because of its greater basicity.
2. Increasing the acidity of the disproportionation catalyst increases the rate of disproportionation.
3. Increasing the catalyst concentration increases the rate of disproportionation.
4. Increasing the reaction time increases the per cent conversion to the dialkyl compound.
5. Best per cent conversions are obtained at low temperatures (0.25^0C), as high temperatures (100^0C) give complex reaction mixtures.
6. No isomerization of the migrating alkyl chain occurs during the disproportionation. 191 pages. $2.50.

PART I: A STUDY OF THE ISOPROPYLCYCLOPENTADIENES. PART II: THE STRUCTURE OF DICYCLOPENTADIENEDICARBOXYLIC ACID.

(L. C. Card No. Mic 58-2437)

Richard James Day, Ph.D.
Cornell University, 1958

PART I

A mixture of isopropylcyclopentadienes has been synthesized by the alkylation of cyclopentadienylsodium with isopropyl iodide. The composition of the diene mixture and the structures of the components have been established by a study of the N-phenylmaleimide and maleic anhydride adducts.

Two N-phenylmaleimide adducts were obtained: adduct a (30-35%), m.p. 171-171.5°, and adduct b (70-65%), m.p. 111-111.5°. Also prepared from these products were the following compounds: dihydro adducts a, m.p. 120-121°, and b, m.p. 186-187°; dihydro hydrazides a, m.p. 99-100°, and b, m.p. 107-108°.

Two products were obtained from aqueous hydrolysis of the non-crystalline anhydride mixture from the diene and maleic anhydride: a lactone acid, m.p. 174-174.5°, and a dibasic acid, m.p. 98-99°. The dibasic acid was related to adduct a; it was also hydrogenated to a dihydro derivative, m.p. 121-123°.

The endo adduct from dimethylfulvene and maleic

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

anhydride was hydrogenated to two isomeric tetrahydro derivatives, m.p. 80° and m.p. 107°. The 80° isomer was converted to the following derivatives: dibasic acid, m.p. 178°; cyclic hydrazide, m.p. 136-137°; N-phenylmaleimide adduct, m.p. 193-194°. The 107° isomer was converted to the following derivatives: dibasic acid, m.p. 196°; cyclic hydrazide, m.p. 149-150°; N-phenylmaleimide adduct, m.p. 173-174°.

Comparison of the derivatives of 5-isopropylcyclopentadiene from the dimethylfulvene series with the corresponding isomeric derivatives of the synthetic isopropylcyclopentadienes showed them to be different. Consequently, 5-isopropylcyclopentadiene is not one of the two isolable components of the diene mixture.

On the basis of ease of lactonization of the dibasic acids from the maleic anhydride adducts and from comparison of the properties of the a series with the α and the b series with the β series of the methylcyclopentadienes, it was concluded that the isomer formed in the larger amount was 2-isopropylcyclopentadiene. The isomer formed in the smaller amount must then be 1-isopropylcyclopentadiene. 5-Isopropylcyclopentadiene could not be detected and presumably was absent.

PART II

The dicyclopentadienedicarboxylic acid resulting from the carboxylation of cyclopentadienylsodium was investigated in an attempt to establish the positions of the carboxyl groups on the dicyclopentadiene nucleus. Spectroscopic evidence already available indicated that both carboxyl groups were present in α,β-unsaturated systems.

Treatment of dicyclopentadienedicarboxylic acid with diazomethane gave a dimethyl ester, m.p. 171.5-172.5°, containing a mole of diazomethane. This was designated as a pyrazoline by analogy to similar reactions of dicyclopentadiene. Base hydrolysis of this ester gave a monomethyl ester of a dibasic acid, m.p. 205.5-207°. This result is consistent with the presence of a tertiary carbomethoxyl group and indicates that the carboxyl group in the bicycloheptane ring is attached to the double bond in that ring.

Pyrolysis of the diazomethane derivative gave two products: a crystalline dimethyl ester (28%), m.p. 140-140.5°, and a noncrystalline material (72%). Hydrolysis of the 140° product gave a monomethyl ester of a dicarboxylic acid, m.p. 216-217°; this result indicates the presence of a tertiary carboxyl group. The noncrystalline material was hydrolyzed to a dibasic acid, m.p. 200-211°; this indicates that the noncrystalline product contains no tertiary carbomethoxyl group. By analogy to pyrolyses of similarly substituted pyrazolines, the 140° product was designated as a cyclopropane derivative and the noncrystalline product as a methyl homolog of the dimethyl ester of dicyclopentadienedicarboxylic acid.

Attempts were made to determine the positions of the carboxyl group and double bond in the five-membered ring by a series of Schmidt, Hofmann, and Curtius degradations on dicyclopentadienedicarboxylic acid or suitable derivatives. The formation of a diketone would conclusively confirm the correctness of the spectroscopic evidence. Unfortunately, none of the attempted degradations was successful, and no new evidence was obtained from this approach. 89 pages. $2.00.

A STUDY OF THE DEMJANOW REARRANGEMENT

(L. C. Card No. Mic 58-1395)

Seyhan Nurettin Ege, Ph.D.
University of Michigan, 1956

The present investigation has consisted of a study of the nitrous acid deamination reactions of cyclobutylcarbinylamine, 1-cyclobutylethylamine, cyclopentylcarbinylamine, trans-2-methylcyclopentylamine, and the cis- and trans-2-methylcyclopentylcarbinylamines. The reactions were carried out with sodium nitrite in aqueous sodium dihydrogen phosphate solutions, and the alcohol mixtures that were formed were analysed for their isomeric constituents by the use of infrared spectrophotometry.

It was found that in the case of cyclobutylcarbinylamine, ring expansion was the predominant reaction, but there was evidence for the presence of unrearranged alcohol and tertiary alcohol. When a methyl group was substituted on the side chain to give 1-cyclobutylethylamine, the amount of ring expansion decreased and more tertiary alcohol was formed. The products were 34% 1-methylcyclopentanol, 29% trans-2-methylcyclopentanol, 20% 1-cyclobutylethanol, and 17% 1-ethylcyclobutanol.

The nitrous acid deamination of trans-2-methylcyclopentylamine proceeded mainly with hydrogen migration to give 70% of 1-methylcyclopentanol and 30% of trans-2-methylcyclopentanol. Cyclopentylcarbinylamine was found to give extensive ring expansion (76%) with the formation of tertiary alcohol (19%) and some unrearranged alcohol (5%) accounting for the rest of the mixture.

The cis- and trans-2-methylcyclopentylcarbinylamines were studied in an effort to gain some understanding of the stereochemistry of the ring expansion. The data from the nitrous acid deamination reactions of these compounds suggest that ring expansion takes place primarily by the migration of the ring carbon carrying the methyl group. Tertiary alcohols seem to be the products of secondary importance with only small amounts of unrearranged alcohol being present. Though the reference samples of the expected products that were used in the analysis of these mixtures were not of unequivocal stereochemical purity, there are indications that the reaction did proceed with some degree of stereospecificity suggesting a concerted mechanism for the deamination.

A considerable part of the experimental work in this investigation was devoted to a study of the stereochemistry of the cyclopentane system. Attempts were made to prepare cis-2-methylcyclopentanecarboxylic acid and cis-2-methylcyclopentylamine by the catalytic hydrogenation of 2-methylcyclopentene-1-carboxylic acid and 2-methylcyclopentanone oxime in acidic media. Considerable amounts of trans isomers were found to be formed. Thus, it was shown that the rules that have been formulated for cyclohexane systems do not always apply in the case of cyclopentane derivatives.

The results of this investigation have been discussed in the light of what is known about the stereochemistry of ring systems and about carbonium ions in general.

129 pages. $2.00.

PART I. SOME REACTIONS OF PERHALOVINYL IODIDE. PART II. THE PREPARATION AND REACTIONS OF SOME DERIVATIVES OF PERFLUOROCYCLOBUTENE

(Publication No. 22,604)

Don Norman Gray, Ph.D.
University of Colorado, 1956

Supervisors: Professors Joseph D. Park and John R. Lacher

This investigation is an extension of other studies initiated by this laboratory and was principally concerned with the preparation and the reactions of the perhalogenated vinyl iodide, $CF_2=CBrI$.

This compound is prepared from readily available starting materials by the following series of reactions.

1. $CF_2=CH_2 + Br_2 \xrightarrow{u.v.} CF_2BrCH_2Br$
2. $CF_2BrCH_2Br + KOH \longrightarrow CF_2=CHBr + KBr + H_2O$
3. $CF_2=CHBr + ICl \longrightarrow CF_2ClCHBrI$
4. $CF_2ClCHBrI + KOH \longrightarrow CF_2=CBrI$

Previous studies indicated that perhalogenated vinyl iodides were susceptible to free radical catalyzed reactions.

Under the influence of ultraviolet irradiation $CF_2=CBrI$ reacted with ethylene to form the corresponding butane and was subsequently converted to the corresponding butadiene. The reactions are as follows:

1. $CF_2=CBrI + CH_2=CH_2 \xrightarrow{u.v.} CF_2=CBrCH_2CH_2I$
2. $CF_2=CBrCH_2CH_2I + KOH \longrightarrow CF_2=CBrCH=CH_2$

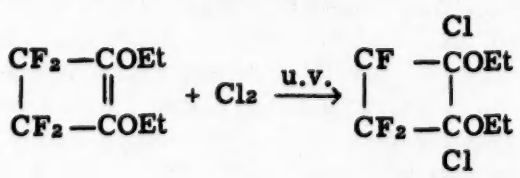
Both $CF_2=CBrI$ and $CF_2=CBr_2$ were found to react with magnesium to form the corresponding Grignard reagent. In contrast, neither $CF_2=CHI$ nor $CH_2=CHBr$ will react under ordinary conditions to form the magnesium salt.

When $CF_2=CBrMgI$ is allowed to react with gaseous formaldehyde, followed by hydrolysis the difluorobromoallyl alcohol, $CF_2=CBrCH_2OH$, is formed. However, no product was isolated when $CF_2=CBrMgI$ was subjected to treatment with carbon dioxide and ethylene oxide respectively.

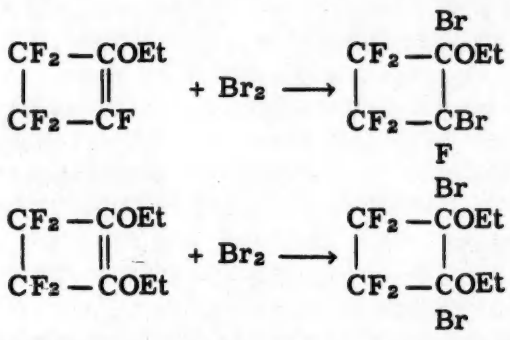
The following reactions were also attempted but were unsuccessful:

(a) The peroxide induced reaction of CF_2BrCH_2Br and ethylene.
(b) The ultraviolet catalyzed reaction of $CF_2ClCHBrI$ and ethylene.
(c) The preparation of the Grignard reagent from $CF_2=CHBr$.

Concurrent with the above work various derivatives of perfluorocyclobutene were prepared. While the preparation of both 1-ethoxy-2,3,3,4,4-pentafluorocyclobutene and 1,2-diethoxy-3,3,4,4-tetrafluorocyclobutene have been reported, it was found in this study that either the mono or the diether could be obtained exclusively by varying the molal ratios under controlled conditions. Both the mono and the diethyl ethers were subjected to chlorination under the influence of ultraviolet light. Under identical reaction conditions, the diethyl ether merely added chlorine.

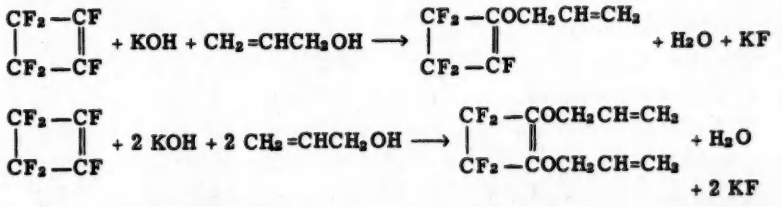


In the mono ethyl ether, on the other hand, addition to the double bond and substitution in the ethyl side chain took place. These substitution products could not be separated; however, the simple addition product could be obtained by a shorter irradiation time. In a similar manner, the dibromo addition products of both the mono and diethyl ether could be obtained with no apparent substitution.



These dibromo adducts were then subjected to extreme thermal conditions in order to ascertain if the corresponding ketones could be obtained by elimination of EtBr. In each case it was found that these alpha haloethers resisted all attempts at pyrolysis.

Two new ethers were prepared from the reaction of basic allyl alcohol and perfluorocyclobutene as shown by the following:



The physical properties and infrared spectrograms of all new compounds prepared in this work were determined.

81 pages. $2.00. Mic 58-5037

TRITYL METHYL KETONE: ITS PREPARATION AND REACTIONS

(L. C. Card No. Mic 58-2259)

Janice L. Greene, Ph.D.
The Pennsylvania State University, 1958

Trityl methyl ketone has been prepared and its behavior in both acidic and basic media has been studied. Three different methods of preparing this ketone were studied: (1) the reaction of acetyl chloride with sodium triphenylmethide, (2) the reaction of triphenylacetyl chloride with methylmagnesium iodide in anhydrous ether, and (3) the acid-catalyzed rearrangement of triphenylpropylene glycol.

The first reaction was found to give a very small yield of the trityl ketone, as the major product was a complex mixture of enolic substances probably arising from multiacylation reactions.

The second method gave little or no trityl methyl ketone. Instead, ethyl triphenylacetate was isolated in 67% yield. This result was explained by assuming a cleavage of the diethyl ether by triphenylacetyl chloride in the presence of magnesium halides.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The trityl methyl ketone was finally prepared by the acid-catalyzed rearrangement of triphenylpropylene glycol. Serious limitations of this method, however, were disclosed since trityl methyl ketone was found to rearrange very rapidly to the isomeric ketone, α,α-diphenylpropiophenone, in strong sulfuric acid. Milder reagents, such as iodine in acetic acid or phosphorus pentoxide in benzene, were found to give mostly trityl methyl ketone.

An additional hazard involved in the use of strong sulfuric acid was the fact that both trityl methyl ketone and α,α-diphenylpropiophenone were easily destroyed by this reagent. The destruction of trityl methyl ketone was calculated to be between three and four times faster than its rearrangement, and more than two hundred times faster than the destruction of α,α-diphenylpropiophenone. Mechanisms have been proposed to explain these reactions.

Trityl methyl ketone has been found to undergo a rapid Claisen-type condensation with itself in the presence of sodium triphenylmethide at temperatures above 200° C. to form triphenylmethane and triphenylacetylacetone in yields of more than 90%. This reaction represents the first recorded instance of the formation of a β-diketone by the self-condensation of a ketone and thus provides an important link between the Claisen and aldol condensations. A mechanism consistent with this viewpoint has been proposed and reactions of other trityl compounds have been correlated and explained on this basis. 92 pages. $2.00.

SELECTIVITY IN THE PYROLYSIS OF TERTIARY ESTERS

(L. C. Card No. Mic 58-2213)

Warren Frederick Hale, Ph.D.
University of Maryland, 1958

Supervisor: Professor William J. Bailey

Since vapor phase chromatography is an excellent tool for the analysis of liquid mixtures, the study of selectivity in ester pyrolysis was extended. It was found that the pyrolysis of acyclic tertiary acetates at high temperatures followed the Hofmann rule but the selectivity was not as high as had been previously reported in the literature. A marked temperature effect was observed in the pyrolysis of t-amyl acetate. At a pyrolysis temperature of 225°, the composition by weight of the resultant olefin mixture was 42% 2-methyl-1-butene and 58% 2-methyl-2-butene; however, under optimum conditions at 400°, the olefin mixture was 75% 2-methyl-1-butene and 25% 2-methyl-2-butene.

This temperature effect was found to occur gradually as the pyrolysis temperature was lowered. The shift in the olefin ratio in favor of the 2-olefin occurred below 300°. To account for this shift, explanations based on the possible importance of the stability of the olefin product or on a possible change to an ionic mechanism were offered. In addition, the pyrolysis of dimethylisopropylcarbinyl acetate, under selected operating conditions, produced a mixture of 87.5% 2,3-dimethyl-1-butene and 12.5% 2,3-dimethyl-2-butene.

Another section of this selectivity study was concerned with the effect of a change in ring size on the direction of elimination in tertiary ring esters. The pyrolyses of 1-methylcyclopentyl acetate, 1-methylcyclohexyl acetate, N-(1-methylcyclohexyl)-acetamide, and 1-methylcycloheptyl acetate were found to yield mixtures of olefins in each case. Thus, under normal operating conditions, the five-ring acetate gave 84% 1-methylcyclopentene and 16% methylenecyclopentane, the six-ring acetate gave 74% 1-methylcyclohexene and 26% methylenecyclohexane, the six-ring acetamide gave 72% 1-methylcyclohexene and 28% methylenecyclohexane, and the seven-ring acetate gave 76% 1-methylcycloheptene and 24% methylenecycloheptane. It was also found that, at lower pyrolysis temperatures, the amount of endo olefin increased in the 1-methylcyclohexyl acetate pyrolysis. However, the change was not nearly as great as had been the case with t-amyl acetate.

In both the pyrolysis of t-amyl acetate and 1-methylcyclohexyl acetate, a considerable number of reaction variables were investigated, e.g., temperature, carbon deposits, purity of the ester, sample size, method of preparing the ester and others. None of these variables, except temperature, was found to have any appreciable effect on the composition of the resultant olefin mixtures.

All of the olefin mixtures in these studies were analyzed by means of the vapor phase chromatograph. The identifications of the peaks obtained on samples of the olefin mixtures were accomplished by the use of authentic olefin samples. Thus, methylenecyclohexane was obtained by pyrolysis of cyclohexylcarbinyl acetate, methylenecyclopentane by a six-step synthesis from 1,1-dicarbethoxycyclopentane in 34% over-all yield and methylenecycloheptane by a six-step synthesis from cycloheptanone in 24% over-all yield. The cyclic endo olefins were prepared by dehydration of the appropriate tertiary alcohols followed by equilibration.

In addition to this selectivity study, the preparation of 1,6-diacetoxy-3,4-di-(acetoxymethyl)-hexane was accomplished in 61% over-all yield by the method of reductive acetylation. Saponification of this tetra-acetate gave a 93% yield of 3,4-di-(hydroxymethyl)-1,6-hexanediol. The pyrolysis of 1,6-diacetoxy-3,4-di-(acetoxymethyl)-hexane did not give the expected 2,3-divinyl-1,3-butadiene.
110 pages. $2.00.

STRUCTURAL STUDIES OF RELATED ARGEMONE ALKALOIDS

(L. C. Card No. Mic 58-2155)

Lemont Burwell Kier, Ph.D.
University of Minnesota, 1958

An examination of Argemone rotundata (Rydberg) has been carried out in order to study its alkaloidal content. The principal new alkaloid found in fair quantity was diphenolic in nature. It has been tentatively named rotundine in accordance with the species name.

Methylation studies on rotundine have related it to the previously isolated argemone alkaloids namely argemonine and norargemonine inasmuch as argemonine was obtained from rotundine. Only preliminary structural studies had heretofore been carried out on the known alkaloids and therefore the research resolved itself into the proof of structure of these three alkaloids.

The molecular formula of rotundine, m. p. 245-5.5,

was found to be $C_{19}H_{21}NO_4$. This was further extended by analysis to $C_{16}H_{10}(OCH_3)_2(OH)_2(NCH_3)$.

Diagnostic benzoylation tests suggested that these alkaloids belonged to the aporphine class of tetrahydroisoquinoline alkaloids.

Oxidative studies utilizing manganese dioxide in sulfuric acid supported the assignment to the tetrahydroisoquinoline group by yielding N-methyl-meta-hemipinimide as well as meta-hemipinic acid.

Oxidation of norargemonine suggested that this monophenolic alkaloid had two methoxyl groups in the benzenoid portion of the isoquinoline ring system. Oxidative studies on rotundine as well as ethylated rotundine led to the assumption that the phenolic hydroxyls were distributed between two benzene rings in the molecule.

Exhaustive methylation led to a series of interesting products for which evidence of the degradative route has been adduced.

Oxidation of the final nitrogen-free compound has led to a tricarboxylic acid, $C_{12}H_3(OCH_3)_4(COOH)_3$, which substantiates the belief that the molecule is an aporphine alkaloid.

On the basis of the chemical studies a structure for this group of alkaloids has been proposed. It is to be emphasized that the structural assignment is not unequivocal and cannot be arrived at by known biogenetic routes.

100 pages. $2.00.

THE SYNTHESIS AND REACTIONS OF BRIDGED POLYCYCLIC COMPOUNDS: SECTION I: THE SYNTHESIS OF THE QUADRICYCLIC RING SYSTEM. SECTION II: THE SYNTHESIS OF BRIDGED POLYCYCLIC DIENES. SECTION III: THE BROMINATION OF BRIDGED POLYCYCLIC COMPOUNDS.

(L. C. Card No. Mic 58-1222)

Robert Thomas LaLonde, Ph.D.
University of Colorado, 1957

Supervisor: Professor Stanley J. Cristol

An investigation was initiated to determine if the light-catalyzed isomerization of bicyclo[2,2,1] heptadiene-2,3-dicarboxylic acid to quadricyclo[2,2,1,$0^{2,6}$,$0^{3,5}$] heptane-2,3-dicarboxylic acid (a quadricyclene derivative) could be extended to other bicyclic and monocyclic dienes. Methyl bicyclo[2,2,1] -heptadiene -2,3-dicarboxylate, 3-phenylbicyclo[2,2,1]heptadiene-2-carboxylic acid, bicyclo[2,2,2] octa-2,5-diene-2,3-dicarboxylic anhydride, and 1,4-cyclohexadiene-1,2-dicarboxylic anhydride were irradiated with ultraviolet light. For the most part these experiments were unsuccessful. Evidence which indicated that the desired isomerization might have taken place was gained from the infrared absorption spectra of the irradiated bicyclic dienes. Only starting material was recovered from the monocyclic diene.

3-phenylbicyclo[2,2,1]heptadiene-2-carboxylic acid, bicyclo[2,2,2]-octa-2,5-diene-2,3-dicarboxylic anhydride, and the corresponding monomethyl ester of this anhydride were synthesized. These dienes were regarded as possible reactants in the ultraviolet-light-catalyzed conversion of a bicyclic diene to a quadricyclene derivative.

The structure of bicyclo[2,2,2]octa-2,5-diene-2,3-dicarboxylic anhydride was confirmed by its conversion to a known derivative.

The reaction of phenylpropiolic acid with cyclopentadiene in a steel bomb gave 2-phenyltricyclo[2,2,1,$0^{2,6}$]-heptan-endo-5-ol-endo-3-carboxylic acid lactone. This lactone was found to be identical with that lactone formed by the action of a strong acid on 3-phenylbicyclo[2,2,1]-heptadiene-2-carboxylic acid.

Derivatives of bicyclo[2,2,1]hetpadiene-2,3-dicarboxylic acid were prepared in order that the acid could be more readily identified and isolated from reaction mixtures.

The bromination of quadricyclo[2,2,1,$0^{2,6}$,$0^{3,5}$]heptane-2,3-dicarboxylic acid in the dark gave a dibromide. The identification of this dibromide as exo-3-exo(or endo)-5-dibromotricyclo[2,2,1,$0^{2,6}$]heptane-2-endo-3-dicarboxylic acid was determined by its conversion, by treatment with warm water, to the known γ-lactone of exo-3-bromotricyclo-[2,2,1,$0^{2,6}$]heptan-endo-5-ol-2-endo-3-dicarboxylic acid. Conversion of this bromolactonic acid, by the use of diazomethane, to the corresponding known methyl ester and the hydrogenolysis to the known γ-lactone of tricyclo-[2,2,1,$0^{2,6}$]heptan-endo-5-ol-2-endo-3-dicarboxylic acid confirmed the identification of the bromolactonic acid.

The zinc debromination of exo-3-exo-(or endo)-5-dibromotricyclo[2,2,1,$0^{2,6}$]heptane-2-endo-3-dicarboxylic acid gave a high melting saturated solid and an unsaturated residue. These products were not identified.

The light-catalyzed bromination of quadricyclo[2,2,1,$0^{2,6}$, $0^{3,5}$]-heptane-2,3-dicarboxylic acid appeared to give the same dibromodicarboxylic acid as the bromination in the dark.

The bromination of bicyclo[2,2,1]heptadiene-2,3-dicarboxylic acid in the dark gave a dibromide which was different from that dibromide obtained from the bromination of quadricyclo[2,2,1,$0^{2,6}$,$0^{3,5}$]heptane-2,3-dicarboxylic acid. The dibromide obtained from the diene was found to be unsaturated and readily absorbed one mole of hydrogen for each mole of unsaturated dibromodicarboxylic acid to give a saturated dibromodicarboxylic acid. This acid in turn was converted to a methyl ester when treated with diazomethane, an anhydride when treated with acetic anhydride, and a bromolactonic acid when treated with warm water.

The non-identity of the methyl ester, bromolactonic acid, and the anhydride with the respective methyl ester, bromolactonic acid and the anhydride obtained from exo-cis-5,6-dibromobicyclo[2,2,1]heptane-endo-cis-2,3-dicarboxylic acid demonstrated that the configuration of the bromine atoms on the saturated dibromodicarboxylic acid and the unsaturated dibromodicarboxylic acid was not the exo-cis-configuration.

The formation of the bromolactonic acid eliminated the possibility that the saturated dibromodicarboxylic acid was endo-cis-5,6-dibromobicyclo[2,2,1]heptane-endo-cis-2,3-dicarboxylic acid. The non-identity of the bromolactonic acid with the known γ-lactone of anti-7-bromobicyclo[2,2,1]heptan-endo-5-ol-endo-cis-2,3-dicarboxylic acid demonstrated that the saturated dibromodicarboxylic acid was trans-5,6-dibromobicyclo[2,2,1]hept-2-ene-2,3-dicarboxylic acid. The formation of bicyclo[2,2,1]hept-5-ene-endo-cis-2,3-dicarboxylic acid from the zinc debromination of the saturated dibromodicarboxylic acid confirmed

the identity of this acid as the trans-dibromide rather than the rearranged dibromide.

Thus by the identification of the saturated dibromide as trans-5,6-dibromobicyclo[2,2,1]heptane-endo-cis-2,3-dicarboxylic acid it was shown that the bromination of bicyclo[2,2,1]heptadiene-2,3-dicarboxylic acid had occurred, in part at least, by trans bromination to give trans-5,6-dibromobicyclo[2,2,1]hept-2-ene-2,3-dicarboxylic acid.

The identification of the saturated dibromodicarboxylic acid as the trans-dibromide showed that the second product obtained from the reported bromination of bicyclo-[2,2,1]hept-5-ene-2,3-dicarboxylic anhydride was syn-5,7-dibromobicyclo[2,2,1]heptane-exo-cis-2,3-dicarboxylic anhydride.

The light-catalyzed bromination of bicyclo[2,2,1]heptadiene-2,3-dicarboxylic acid gave different results than the bromination in the dark. 181 pages. $2.40.

APPLICATION OF CARBON-14-LABELED CYANIDE TO STUDIES OF CARBOHYDRATES

(L. C. Card No. Mic 58-2221)

Joseph Donald Moyer, Ph.D.
University of Maryland, 1958

Supervisors: Dr. H. S. Isbell and
Professor Nathan L. Drake

Detailed directions, based on a method developed by Sixma and associates for preparing millimole quantities of cyanide, are given for the preparation of alkali cyanide-C^{14} from barium carbonate-C^{14} in 90 to 95% yield. Barium carbonate-C^{14} was ignited at 640° C. with ammonium chloride and metallic potassium to give potassium cyanide-C^{14}

New methods were developed for the analysis of carbon-14-labeled alkali cyanide and barium carbonate. The procedures for the determination of total radioactivity, radioactivity in the form of cyanide, and specific radioactivity, are based on reaction of the cyanide with a reducing sugar, and measurement of fixed carbon-14 in either formamide or alkaline ethylene glycol solution, by means of a proportional counter. Carbon dioxide, formed by acid treatment of barium carbonate-C^{14} or by wet oxidation of carbon-14-labeled cyanide was absorbed in alkaline ethylene glycol; the solution was then counted directly in a porportional counter.

An analytical method was developed for the determination of reducing sugars in quantities of less than 0.001 mmole, by application of the cyanohydrin reaction using C^{14}-labeled cyanide. The sugar was allowed to react in an excess of cyanide in a buffered solution at 55° C. The excess cyanide was volatilized as hydrocyanic acid and the residual radioactivity determined. Non-reducing sugars do not interfere with the method. Aldose monosaccharides and some reducing disaccharides fixed one mole of cyanide per mole of reducing sugar. Ketose monosaccharides and alkali-labile disaccharides combined with somewhat more than one mole of cyanide per mole; and, for best results, unknowns should be determined by comparison with parallel measurements of known quantities of the sugars. Lactulose and turanose gave erratic results and their determination by this method was unsatisfactory. Mechanisms are presented to account for the high values obtained.

For the measurement of reducing end-groups in dextran, a modification of the method is recommended, because a small amount of splitting was indicated by an increasing radioactivity with extended reaction-times. The recommended method was used for measuring molecular weights of dextran samples in a program on plasma expanders. The condensation of cyanide and dextran was carried out at room temperature, in a more alkaline medium than was used with sugars. Results obtained by the cyanide method and by various copper-reduction methods are in reasonable agreement. Application of the method to the measurement, in triplicate, of 83 samples of clinical dextran showed an average deviation of 2.3% for each of the samples.

The preparation of carbon-14 carboxy-labeled carboxydextran and carboxyinulin was accomplished through the reaction of C^{14}-labeled cyanide with dextran or inulin. The labeling of two different lots of dextran and of one of inulin was carried out by transferring the excess cyanide from one reaction flask into the next by lyophilizing a frozen mixture containing the hydrocyanic acid released by a cation-exchange resin. Recovery of radioactivity in the preparations and in the reclaimed cyanide was 81% of the starting radioactivity.

A procedure was developed for the determination of small quantities of specific reducing sugars in mixtures by the application of isotope-dilution techniques. After reaction of the sugars with C^{14}-labeled cyanide, the products were analyzed by the "carrier addition" method of analysis. The feasibility of applicability of the method was demonstrated by the satisfactory determination of nine representative reducing sugars and by the results of analysis of a mixture containing four of the sugars. The method was applied to the estimation of 1,3'- and 1,4'-linkages, in the structural analysis of 5 samples of clinical dextran from various sources. For the 1,3'-linkages, values of from 3.6 to 13.0% were obtained, and for the 1,4'-linkages, 0.8 to 1.4%. 116 pages. $2.00.

MECHANISMS OF ELIMINATION REACTIONS: PART I – THE REACTIONS OF 2-BROMOCYCLOHEXANOLS AND SOME DERIVATIVES WITH ZINC. PART II – 1,4-CONJUGATE ELIMINATION IN THE MESO-DIHYDROANTHRACENE SERIES.

(Publication No. 22,630)

Leo E. Rademacher, Ph.D.
University of Colorado, 1956

Supervisor: Professor Stanley J. Cristol

The elimination of groups situated on adjacent carbon atoms (1,2-elimination) has been shown in a number of cases to be facilitated by having the groups in the trans position. This preference has been shown to be due primarily to a difference in energies of activation and has been explained by a duality of mechanism, the trans configuration allowing for a one-step concerted process with a transition state of comparatively low energy and the cis

configuration necessitating a multiple-step carbanion process, the transition state leading to the carbanion normally being of comparatively high energy. Zinc promoted elimination of bromine from acyclic vicinal dibromides has been shown to proceed largely in the trans fashion, and elimination of bromine and arenesulfonate groups from 2-bromocyclohexyl arenesulfonates by iodide ion has likewise been shown to be faster when the groups are trans.

Elimination from the latter type of compounds using zinc has not been studied kinetically.

cis- and trans-2-Bromocyclohexanols and their acetate and p-toluenesulfonate esters and trans-2-bromocyclohexyl ethyl ether were prepared and refluxed with zinc in ethanol for various lengths of time to determine if any difference in reactivity between cis and trans isomers could be detected.

Only in the case of the p-toluenesulfonates was there any detectable difference in reactivity, the trans isomer reacting about 7 times as fast as the cis isomer. The 2-bromocyclohexanols and their acetates were much less reactive than the p-toluenesulfonates, they gave much lower yields of cyclohexene, and isomeric pairs reacted at about the same rate.

The absence, or near absence, of a preference for trans elimination suggests that both cis and trans elimination go via a multiple-step carbanion process or, perhaps, a free radical process, probably because the reaction takes place on the surface of a metal which may make it significantly different from reactions in solution.

It has been proposed that a similar duality of mechanism is operative in 1,4-conjugate elimination, in which case, a similar concerted, one-step process would be possible when the groups to be eliminated are cis.

Previous work in the 9,10-dihydroanthracene series has indicated that cis-1,4- elimination is indeed preferred over trans, but in some cases the preference was quite small and in one case, perhaps, insignificant. It has recently been reported that trans-1,4-conjugate elimination is preferred over cis in the base promoted elimination of hydrogen chloride from various isomers of benzene tetrachloride. In view of the confused picture presented by the available information it was deemed advisable to study the elimination reaction in the 9,10-dihydroanthracenes more thoroughly.

The elimination of water from cis- and trans-1,5-dichloro-9,10-dihydro-9,10-anthradiols had been studied briefly and there appeared to be a large preference for cis elimination here.

A kinetic study of the elimination of water from both the above diols and from cis- and trans-9,10-dihydro-9,10-anthradiols was undertaken and, although some complications due to instability of the latter trans diol made the kinetic data of doubtful accuracy, it was definitely established that a preference for cis elimination exists in both series. This preference cannot be explained by ion-dipole interactions but it may be enhanced by both steric and ion-dipole interactions resulting from the presence of the chlorine atoms in the 1 and 5 positions.

The large preference for cis elimination (by a factor of about 4,400 to 1 in relative rates) in the unsubstituted diols seems to indicate quite definitely that steric interactions cannot account for the observed results in 9,10-dihydroanthracenes.

Preliminary work on the elimination of benzoic acid from cis- and trans-9,10-dihydro-9,10-anthradiol dibenzoates in basic alcoholic dioxane indicates that complications due to side reactions are as bad, if not worse, than those found in the case of the diacetates. The reaction was not studied in any detail so it is impossible to say whether or not a significant difference in reactivities exists. The yield of anthraquinone, the final product of the reaction, was about 8 times as large in the case of the trans isomer, however (hydrogen and benzoxy groups cis).

The thermal decomposition of 9-methoxy-9,10-dihydroanthracene-cis-9,10-bis-(2-isobutyronitrile), the corresponding trans isomer, and the analogous trans 9-bromo compound showed that the elimination of methanol or hydrogen bromide was not clean, if it occurred at all. Nineteen to 38% of 9-methoxyanthracene was isolated from the decomposition products of the methoxy compounds, and a complex mixture which could not be easily separated was obtained from the bromo compound.

It does not seem possible to reconcile the difference in behavior between the 9,10-dihydroanthracenes and the benzene tetrachlorides with the available information. The work described herein, however, helps to establish that a general preference for cis-1,4-conjugate elimination exists in the 9,10-dihydroanthracene series.

114 pages. $2.00. Mic 58-5038

REARRANGEMENTS OF DIARYL SULFONES

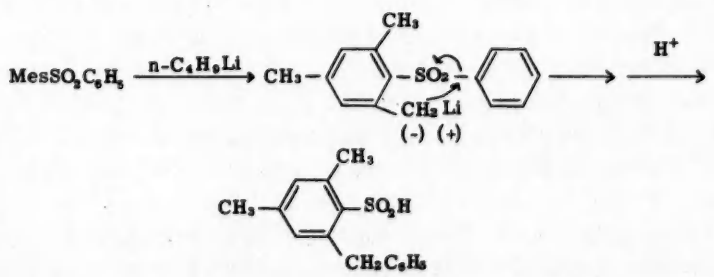
(Publication No. 22,288)

William J. Ray, Jr., Ph.D.
Purdue University, 1957

Major Professor: William E. Truce

I. The Synthesis and Butyllithium-Induced Rearrangement of o-Methyldiaryl Sulfones

The novel rearrangement of mesityl phenyl sulfone to 2-benzyl-4,6-dimethylbenzenesulfinic acid (I) via reaction with n-butyllithium is reported. The yield was greater than 98% when the reaction was carried out in refluxing ether with equimolecular amounts of the reactants. The following reaction mechanism is postulated by analogy with the Smiles rearrangement[1] of 2-hydroxy-2'-nitrodiphenyl sulfones.



I

2-Benzyl-4,6-dimethylaniline was prepared by the action of aluminum chloride on N-benzyl-2,4-dimethylaniline at 200°. (Davies, et. al.,[2] have reported the analogous preparation of 2-benzyl-4-methylaniline from N-benzyl-p-toluidine.) The amino group of this aniline was replaced by the sulfinic acid group by the method of Gattermann,[3] giving an acid whose identity to I verified the structure of the rearrangement product.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Mesityl p-tolyl sulfone also rearranged when treated with n-butyllithium giving a sulfinic acid which was oxidized and subsequently desulfonated to give 2,4',5-trimethyldiphenylmethane. This substantiates the proposed mechanism since the p-tolyl configuration of the starting sulfone was maintained in the product.

The preparation of phenyl o-tolyl, phenyl 2,4-xylyl, phenyl 2,6-xylyl and dimesityl sulfones is described. The following reaction schemes are illustrative.

$$ArSO_2Cl + Ar'H \longrightarrow ArSO_2Ar'$$

1) Ar = o-tolyl, Ar' = phenyl
2) Ar = 2,4-xylyl, Ar' = phenyl
3) Ar = Ar' = mesityl

$$ArLi + C_6H_5SM \longrightarrow ArSAr' \xrightarrow{[O]} ArSO_2Ar'$$

1) Ar = o-tolyl, M = C_6H_6S
2) Ar = 2,6-xylyl, M = Cl

Phenyl 2,6-xylyl and dimesityl sulfones rearranged to the corresponding substituted o-benzylbenzenesulfinic acids in high yields on treatment with n-butyllithium, Phenyl 2,4-xylyl and phenyl o-tolyl sulfones also rearranged but only 65 to 70% conversions were realized, most of the unreacted sulfone being recovered. The lower conversions here are attributed to the concurrent metalation of phenyl o-tolyl sulfones, not only at the ortho methyl group, but also at the unsubstituted positions ortho to the sulfone group. Shielding of these unsubstituted ortho positions by the methyl groups of the 2,6-disubstituted sulfones accounts for the much higher conversions in the rearrangements of mesityl phenyl and phenyl 2,6-xylyl sulfones.

The sulfinic acids obtained via the rearrangements of phenyl 2,4-xylyl and phenyl o-tolyl sulfones have been synthesized by an independent method involving the replacement of the amino group of the known 2-benzyl-4-methylaniline[2] and 2-benzylaniline,[4] respectively, by the sulfinic acid group.

II. The Kinetics of the Reaction of o-Methyldiaryl Sulfone with n-Butyllithium

A kinetic study of the n-butyllithium-induced rearrangement of mesityl phenyl, phenyl o-tolyl, phenyl 2,4-xylyl, phenyl 2,6-xylyl, and dimesityl sulfones in refluxing ether is reported. The reaction was followed by utilizing the water insolubility of ferric sulfinates.[5] Thus, an aliquot of the reaction mixture was treated with standard ferric chloride solution and filtered from the precipitated ferric sulfinate after digestion. The filtrate was analyzed colorimetrically[6] for excess iron, the procedure being standardized for each sulfone with samples of the purified sulfinic acids.

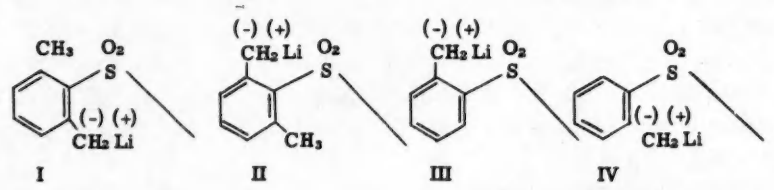
For each sulfone, the metalation step was found to occur almost instantaneously under the conditions employed, the subsequent rearrangement being rate determining. In phenyl 2,6-xylyl-type sulfones such as mesityl phenyl sulfone, the two ortho methyl groups were not equivalent. In such cases, the rearrangement occurred in two stages, the rate of the first stage, which accounted for 20 to 25% of the reaction, being much too fast to follow. The first order rate constants for the second stage of these rearrangements are recorded in Table I. The rearrangement of sulfones containing a single ortho methyl group, however, exhibited simple, first order kinetics.

TABLE I

Sulfone	k (min.$^{-1}$)	Relative Rate
Phenyl 2,6-Xylyl	0.310	82
Mesityl Phenyl	0.255	68
Phenyl 2,4-Xylyl	0.0250	7
Phenyl o-Tolyl	0.0182	5
Dimesityl	0.00378	1

The following observations are consistent with the above facts:

(1) The rotation of the 2,6-xylyl group about the carbon-sulfur bond is restricted in phenyl 2,6-xylyl-type sulfones. Thus, the metallation of such sulfones effectively produces two different compounds which may be represented as I and II. Here the phenyl ring lying in the plane of the paper is drawn as usual and the phenyl ring whose



I II III IV

plane is perpendicular to the plane of the paper is represented by a straight line. Metalation of phenyl o-tolyl-type sulfones gives only III.

(2) The transformation I $\longrightarrow$ $ArSO_2Li$ represents the first stage of the rearrangement of phenyl 2,6-xylyl-type sulfones and is quite rapid.

(3) The transformation II $\longrightarrow$ I is the rate controlling step in the overall reaction II $\longrightarrow$ $ArSO_2Li$. This is verified by comparison of the rates of rearrangement of mesityl phenyl and dimesityl sulfones.

(4) The rate determining factor in the reaction III $\longrightarrow$ $Ar'SO_2Li$ is the step IV $\longrightarrow$ $Ar'SO_2Li$ and not the transformation III $\longrightarrow$ IV. The origin of the difference in the rates of the reactions I $\longrightarrow$ $ArSO_2Li$ and IV $\longrightarrow$ $Ar'SO_2Li$ is thought to be steric in nature since I and IV differ only by a 6-methyl group and since a 4-methyl group has little effect on the rate of rearrangement. A somewhat similar effect has been described in the Smiles rearrangement.[7]

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185 pages. $2.45. Mic 58-5039

(I.) THE REACTION OF MALEIC HYDRAZIDE (II.) OZONOLYSIS OF ISOCYANIDES.

(L. C. Card No. Mic 58-1811)

Harry Rubinstein, Ph.D.
Purdue University, 1958

Major Professor: Henry Feuer

I. MALEIC HYDRAZIDE. I. REACTIONS WITH SELECTED ELECTROPHILIC REAGENTS.

It has been established that the reaction of maleic hydrazide (I) with benzenesulfonyl chloride or with acetic anhydride leads to the O-substituted maleic hydrazides 3-(1H-6-pyridazinonyl) acetate (II) and 3-(1H-6-pyridazinonyl) benzenesulfonate (III). They differed from the corresponding N-substituted isomers 1-acetyl-2-hydro-3, 6-pyridazinedione (IV) and 1-benzenesulfonyl-2-hydra-3, 6-pyridazinedione (V) which resulted from the treatment of 1-acetyl-2-maleic acid hydrazine (VI) or 1-benzenesulfonyl-2-maleic acid hydrazine (VII) with acetic acid.

The reaction of VII or 1,2-dimaleic acid hydrazine (VIII) with thienyl chloride gave respectively, N-aminobenzenesulfonylmaleimide (IX) and bis-malemide (X). Compound IX was converted to V in basic as well as acidic medium.

II. MALEIC HYDRAZIDE. II. ATTEMPTS TO PREPARE BICYCLIC DIMALEIC HYDRAZIDE. PREPARATION OF 1-(3',1'(H)-6'-PYRIDAZINONE)-3,6-PYRIDAZINEDIONE.

The reactions of maleic hydrazide (I) were found to be different from those of cyclic succinhydrazide (II). Under conditions where II gave bicyclic disuccinhydrazide (III), I did not react. A possible explanation for this difference is given. Compound I reacted with benzenesulfonyl chloride to give 1-(3',1'(H),6',-pyridazinone)-3,6-pyridazinedione (IV). The structure of IV was proven by converting it to 1-(3'-chloro-6'-pyridazyl)-3-chloro-6-pyridazine. The reaction of I and maleic anhydride with chlorine is discussed.

III. REACTIONS OF ALKYL ISOCYANIDES WITH OZONE.

The reaction of alkyl isocyanides with ozone has been found to give exclusively the corresponding isocyanates. The yields of the isocyanates varied from four to sixty-one percent based upon the conversion of the isocyanates with ammonia to the urea. It appears that increasing concentrations of ozone will result in excellent yields of isocyanates. 150 pages. $2.00.

THE SYNTHESIS OF SOME NEW ALKYL- AND ARYLAMINOALKYL ARYL SULFIDES

(L. C. Card No. Mic 58-2309)

Robert Eben Schaffrath, Ph.D.
Syracuse University, 1958

Supervisor: Gerald F. Grillot

Aromatic amines, which do not give simple products when condensed with phenols and formaldehyde, have been found to react smoothly to give S-alkylation products, rather than C-alkylation products, when condensed with aromatic thiols and formaldehyde.

This variation of the Mannich reaction has been studied using such primary aromatic amines as aniline, the monochloroanilines, p-nitroaniline, p-anisidine, p-toluidine, and mesidine, and aromatic thiols such as thiophenol, p-chlorobenzenethiol, thiomesitol and pentachlorobenzenethiol, forming N-arylaminomethyl aryl sulfides.

It was found in the case of aniline, that one or both of the amino-hydrogens could be replaced, depending only upon the ratio of the reactants. This has been shown to differ from the behavior of an aliphatic primary amine which gave a product consisting of a mixture of mono- and di-(arylmercaptomethyl)amines when used in this reaction. The mixture proved to be difficult to separate.

Secondary aromatic amines, such as N-methylaniline, N-methyl-p-anisidine and N-methyl-p-nitroaniline, gave the normally expected products, N-methyl-N-arylaminomethyl aryl sulfides, when used in this reaction.

The structures of the products were confirmed by infrared analysis after chemical methods gave inconclusive results. Absorption bands were found which were characteristic of secondary aromatic amines or tertiary aromatic amines as predicted, and in none of the spectra was a thiol absorption band found. A new absorption band, characteristic only of the tertiary amines of this series, was found.

During attempts to obtain neutral equivalents of the condensation products of aniline, formaldehyde and the aromatic thiols, abnormalities were found during potentiometric titrations with perchloric acid/acetic acid in which the experimental neutral equivalents were twice the formula weights. This phenomenon was investigated and possible explanations offered.

The N-phenylaminomethyl aryl sulfides, which give abnormal results when titrated potentiometrically with perchloric acid/acetic acid give essentially normal results when titrated potentiometrically with a stronger acid, acetylium perchlorate, or titrated conductometrically with perchloric acid/acetic acid.

The effect of using anilines substituted with nucleophilic and electrophilic groups on this phenomenon of double neutral equivalents was investigated, as well as the effect of separating the sulfur and nitrogen atoms by two carbon atoms, as in the N-phenylaminoethyl aryl sulfides. The effect of using an aliphatic amine was also investigated.

The N-methyl-N-arylaminomethyl aryl sulfides give normal results on potentiometric titration with perchloric acid/acetic acid as long as the N-aryl-substituent was not strongly electrophilic. 153 pages. $2.05.

SYNTHESIS OF ACIDS BY THE PYROLYSIS OF ESTERS AND BLOCKING GROUPS FOR AMINO AND HYDROXYL GROUPS

(L. C. Card No. Mic 58-2226)

William Norbert Turek, Ph.D.
University of Maryland, 1958

Supervisor: Professor William J. Bailey

The pyrolysis of ethyl caproate, caprylate, laurate, myristate, palmitate, stearate, β-ethoxypropionate, and 2,4,6-trimethylbenzoate to the corresponding acids was studied. Yields, ranging from 86-90%, based on unrecovered ester, were obtained in all cases except for ethyl β-ethoxypropionate which gave only a 64% yield of β-ethoxypropionic acid. Whereas the lower molecular weight esters, ethyl caproate and ethyl caprylate, could be pyrolyzed at 560° without serious decomposition, it was necessary to pyrolyze the higher molecular weight esters, ethyl laurate, ethyl myristate, ethyl palmitate, and ethyl stearate, at lower temperatures (520-540°) because considerable breakdown of these ethyl esters into gaseous and liquid products occurred at 560° and above. For example, when ethyl stearate was pyrolyzed at 600°, only a 22% yield of stearic acid was obtained. In order to compare the pyrolysis method with a customary hydrolysis, ethyl stearate was hydrolyzed with alcoholic potassium hydroxide. A 92% yield of stearic acid was obtained by hydrolysis of ethyl stearate, whereas the pyrolysis of ethyl stearate gave an 86% yield of stearic acid. The pyrolysis method, however, had the advantage that it did not require any chemical reagents.

In another phase of this research a search for an amino acid blocking group which could be removed by pyrolysis was begun. Initial work employed a blocking reagent consisting of a chloroformate which would form a urethan with an amino acid. After the protected amino acid was coupled with another amino acid, the blocking group supposedly could be removed in the form of carbon dioxide and an olefin. A series of alcohols were studied with regard to the ease of formation of the chloroformates and the ease of pyrolysis of the urethans resulting from the reaction of the chloroformates with aniline or glycine. It was necessary to pyrolyze the carboxymethyl urethan from β-phenylethanol at such a high temperature that no glycine was isolated. Although the pyrolysis of the carboxymethyl urethan from 9-fluoroenylmethanol occurred at a low temperature, the synthesis of the urethan was difficult. Another alcohol, methyl α-hydroxyisobutyrate was unsatisfactory because the cyclic oxazolidine was formed when the corresponding chloroformate was reacted with glycine or aniline. A series of cyanohydrins were studied next. Acetone cyanohydrin was unsatisfactory because the chloroformate was difficult to make and its phenylurethan required a high temperature for pyrolysis. Very little pyrolysis of the phenylurethan of dibenzyl ketone cyanohydrin occurred at 240° and a high-melting, unidentified solid was obtained from the pyrolysate. The cyanohydrin of 9-acetylfluorene could not be purified by recrystallization. A synthesis of the phenylurethan from this alcohol, phosgene, and aniline could not be accomplished. In general the alcohols that were studied did not lead to suitable blocking reagents for amino acids.

An attempt was made to synthesize the pure β-butyrate of propylene glycol by blocking the α-hydroxyl group with α-carbomethoxyisopropyl chloroformate, followed by butyrylation and then removal of the blocking group by pyrolysis. The reaction between α-carbomethoxyisopropyl chloroformate and propylene glycol proceeded to give principally β-hydroxy-n-propyl α-carbomethoxyisopropyl carbonate in 60% yield. After β-butyroxy-n-propyl α-carbomethoxyisopropyl carbonate was synthesized from the above compound in 73% yield by the use of butyryl chloride, this diester was pyrolyzed at 380° to product 2-butyroxy-1-hydroxypropane, carbon dioxide, and methyl methacrylate in yields of 53%, 69%, and 60%, respectively.

In order to determine the purity of 2-butyroxy-1-hydroxypropane the other isomer, 1-butyroxy-2-hydroxypropane, was synthesized in 89% yield from 1-butyroxypropanone-2 by hydrogenation over copper-chromite catalyst. The infrared spectra, refractive indices, and elution times of the vapor phase chromatograms of the two isomers were nearly identical. For these reasons the possibility of the presence of 1-butyroxy-2-hydroxypropane in the sample of 2-butyroxy-1-hydroxypropane obtained from pyrolysis could not be eliminated. 105 pages. $2.00.

CONDENSATION OF α-ALKYL-α-CARBETHOXY-γ-BUTYROLACTONES WITH MONO- AND DIPHENYLGUANIDINE

(Publication No. 24,964)

Herwart Curt Vogt, Ph.D.
University of Delaware, 1957

Supervisor: Dr. Glenn S. Skinner

The reaction between substituted malonic esters and monophenylguanidine in the presence of sodium ethoxide gives the 5,5-dialkyl-2-phenyliminobarbituric acids. The fact that acid hydrolysis of the phenylimino group gives the corresponding 5,5-dialkylbarbituric acids established the position of the phenyl group. Further proof is provided by the result of the reaction between 5,5-diethyl-2-thiobarbituric acid with aniline to give the identical compound.

The reaction between substituted malonic esters and diphenylguanidine in the presence of alcoholic potassium ethoxide gives the 5,5-dialkyl-1-phenyl-2-phenyliminobarbituric acids. The structures are corroborated by hydrolysis of the phenylimino group to the ensuing 5,5-dialkyl-1-phenylbarbituric acids.

The formation of 2-phenyliminobarbituric acids and 1-phenyl-2-phenyliminobarbituric acids indicates that condensation between substituted guanidines and malonic esters proceeds by reaction at the primary amino group followed by ring closure at the other primary amino group, if it is available.

As the degree of substitution is increased on the barbituric acids the yields and the melting points decrease. Thus, the highest yields are obtained when diethyl malonate is used, the lowest yields when diethyl ethylisoamylmalonate is used.

The reaction between α-alkyl-α-carbethoxy-γ-butyrolactones and monophenylguanidine carbonate in the presence of alcoholic sodium ethoxide gives the 5-alkyl-5-β-hydroxyethyl-2-phenyliminobarbituric acids. The structure

of the β-hydroxyethylphenyliminobarbituric acids is elucidated by converting it to the 5-alkyl-5-ethyl-2-phenyliminobarbituric acids by means of a Mozingo type hydrogenolysis of the β-ethylmercaptoethyl derivatives. The hydroxyl group is replaced by bromine which is reacted with sodium ethyl mercaptide to give the 5-alkyl-5-β-ethylmercaptoethyl-2-phenyliminobarbituric acid.

90 pages. $2.00. Mic 58-5040

CORRELATIONS OF ORGANIC SOLUTION SCINTILLATORS AND CHEMICAL CONSTITUTION

(L. C. Card No. Mic 58-2203)

Eugene Allen Weipert, Ph.D.
Iowa State College, 1958

Supervisor: Henry Gilman

An history of investigations into the nature of the scintillation process was presented. All solvents and solutes screened for potential scintillator application were tabulated. Previously employed methods of synthesis of chain-type polyaryls and derivatives were reviewed.

Several new compounds of this general type synthesized by a variety of methods, and their properties examined.

Correlations between the constitution and scintillation ability of these compounds were discussed with reference to ring systems and functional groups.

The general methods of synthesis employed were discussed with respect to simplicity and versatility.

An unusual dealkylation reaction of hydrogen selenide was encountered and attempts were made to establish its generality.

An attempt was made to determine the nature of the intermediate in the reaction between organometallic reagents and alkoxyamines.

Exhanced reactivity of metals and metal amides in tetrahydrofuran was observed in two instances.

142 pages. $2.00.

STUDIES ON THE SYNTHESIS OF α-METHOXY ACIDS

(L. C. Card No. Mic 58-2228)

Charles William Woods, Ph.D.
University of Maryland, 1958

Supervisor: Professor Wilkins Reeve

The preparations of some α-methoxy acids are described. α-Methoxyphenylacetic acid was prepared in 38% of the theoretical yield by the one step reaction of benzaldehyde, chloroform, and sodium methoxide in methanol. Methyl α,β-diphenylglycidate was found to be the principal side-reaction product, and a Darzens reaction type mechanism is proposed to explain its formation. The one step conversion of an aryl aldehyde, chloroform or bromoform, and sodium methoxide in methanol to the α-methoxyarylacetic acid was used to prepare α,2,3-trimethoxyphenylacetic acid, α,2-dimethoxyphenylacetic acid, α,3,4-trimethoxyphenylacetic acid, 3,4-diethoxy-α-methoxyphenylacetic acid, 2-ethoxy-α-methoxyphenylacetic acid, and 4-isopropyl-α-methoxyphenylacetic acid. The yields varied between 19% and 32% of the theoretical amounts. In four cases it was possible to purify the acids by means of their sodium acid salts; the latter could be readily recrystallized from water or alcohol. The use of bromoform was of considerable advantage in the preparation of α,3,4-trimethoxyphenylacetic acid; this acid could not be prepared using chloroform.

α-Methoxy-2-furanacetic acid was prepared from furfural by a three step process. The furfural was reacted with chloroform in the presence of potassium hydroxide to give trichloromethyl-2-furancarbinol. This on treatment with sodium methoxide in methanol yielded methyl α-methoxy-β-furanacetate which was hydrolyzed to the acid. 4-Bromo-α-methoxyphenylacetic acid was prepared in a similar manner by the reaction of 4-bromo-α-(trichloromethyl)benzyl alcohol with potassium hydroxide in methanol. In this case the trichloromethylcarbinol was prepared by the reaction of chloral with p-bromophenylmagnesium bromide. The acid was purified by recrystallization of the sodium acid salt.

α-Methylmercaptophenylacetic acid was prepared by the reaction of sodium thiomethylate with methyl α-bromophenylacetate. The acid would not form a sodium acid salt.

Methyl α-methoxy-3-indoleacetate was obtained by a six step synthesis starting from indole. Indole was treated with oxalyl chloride and then with methanol to give methyl 3-indoleglyoxylate. This was acetylated in the N position, and the keto group was reduced to a hydroxyl group with aluminum amalgam. Methylation of the hydroxyl group was accomplished by reaction with methyl iodide and silver oxide, and the acetyl group was removed by treatment with sodium methoxide in methanol. The free acid was unstable and could not be isolated.

The solubilities of the sodium acid salts that were prepared were determined. The acids were tested to determine whether they would form a lithium acid salt. Such a salt was obtained from 4-bromo-α-methoxyphenylacetic acid, but preliminary work indicated it was not suitable for use as a reagent for lithium. 82 pages. $2.00.

CHEMISTRY, PHARMACEUTICAL

SYNTHESIS OF SOME ALIPHATIC AND BASIC ALKYL ESTERS OF AZOBENZOIC ACIDS

(L. C. Card No. Mic 58-1218)

Tony Everett Jones, Ph.D.
University of Colorado, 1957

Supervisor: Associate Professor Fred G. Drommond

A survey was made of local anesthetics as reported in the scientific literature and the more active compounds are summarized. Compounds most often synthesized for local anesthetic activity are the alkylaminoalkyl esters of

aromatic acids. In most compounds with local anesthetic activity, the carbonyl group is attached to a conjugated system; e.g., procaine, an ester of p-amino-benzoic acid, possesses good local anesthetic activity. However, when a methylene group separates the carbonyl of the ester from the conjugated system of the aromatic phenyl group, as for example with esters of phenylacetic acid, no local anesthetic activity is observed. In contrast, the alkylaminoalkyl esters of cinnamic acid possess local anesthetic activity. Therefore, it has been postulated that local anesthetic activity is due, at least in part, to the carbonyl group being attached to a conjugated system.

The objectives of this research were to investigate chemically and prepare compounds in which the conjugated system extended from two aromatic acids through an azo linkage. Historical literature records information on compounds of this nature, and the mono-esters do show good local anesthetic activity. However, no alkylaminoalkyl diesters have been reported in which the conjugated system of dicarboxylic acid compounds is continued through an azo linkage. The azobenzene derivatives were reviewed, and all the compounds reported were used chiefly in the dye industry. Therefore, the azobenzoic acids were selected for this investigation, and three azobenzoic acids were prepared: p-azobenzene-4:4'-dicarboxylic acid, m-azobenzene-3:3'-dicarboxylic acid, and p-phenylazobenzoic acid. These acids were prepared by slight modifications of the methods reported in the scientific literature. By a variation of the procedures used in the preparation of these compounds, a better yield of these acids was obtained than had previously been reported. Also, the acid chloride of each of these acids was prepared, and in their preparation it was possible to vary the procedures to obtain a better yield, a shorter time of preparation, and a more purified product than had previously been reported in the literature.

Di-esters of p-azobenzene-4:4'-dicarboxylic acid and m-azobenzene-3:3'-dicarboxylic acid were prepared from methyl, ethyl, propyl, and butyl aliphatic alcohols. Also, the mono-esters of p-phenylazobenzoic acid were prepared from methyl, ethyl, propyl, and butyl aliphatic alcohols. The preparation of these mono and di-esters required no special equipment.

Preparation of di-esters from p-azobenzene-4:4'-dicarboxylic acid and m-azobenzene-3:3'-dicarboxylic acid was made with diethylaminoethanol, diethylamino-1-propanol, diethylamino-2-propanol, dimethylaminoethanol, morpholinoethanol, morpholino-1-propanol, piperidinoethanol, piperidino-1-propanol, and piperidino-2-propanol. The preparation of each of these esters required no special equipment, but in most instances the reaction required extreme heat over a long period of time. The di-hydrochloride salt of each of these esters was prepared and analyzed for nitrogen content. No carbon and hydrogen analysis was made. The uncorrected melting point of each compound is reported.

The mono-esters of p-phenylazobenzoic acid were prepared with diethylaminoethanol, diethylamino-1-propanol, diethylamino-2-propanol, dimethylaminoethanol, morpholinoethanol, morpholino-1-propanol, piperidinoethanol, piperidino-1-propanol, and piperidino-2-propanol. No special equipment was required in the preparation of these esters. The hydrochloride salt of each of these esters was prepared and analyzed for nitrogen content. A carbon and hydrogen analysis was not made. The uncorrected melting point of each compound is reported.

None of these compounds was tested pharmacologically. Evidence of local anesthetic activity was observed when a small amount of each ester was placed on the tongue and lips. 107 pages. $2.00.

CHEMISTRY, PHYSICAL

THE MOLECULAR STRUCTURES OF TRIFLUOROMETHYL BROMIDE, TRIFLUOROMETHYL IODIDE, TRIFLUOROMETHYL CYANIDE, AND TRIFLUOROMETHYL SULFURPENTAFLUORIDE.

(L. C. Card No. Mic 58-1372)

Richard Eugene Anderson, Ph.D.
University of Michigan, 1956

The purpose of this electron diffraction investigation was to determine the structures of the gaseous molecules of CF_3Br, CF_3I, CF_3CN and CF_3SF_5. The study of these molecules represents the continued interest in precise structural data for simple organic compounds containing fluorine.

Recent developments in the electron diffraction method have lead to greatly increased precision in the intensity data, but in the course of the present work it was found necessary to consider more carefully several steps in the interpretational procedure. One of these is the problem of resolving the Gaussian components of the composite peaks in the radial distribution function from which the final values of the molecular parameters are obtained. Of two methods of obtaining more reliable resolutions the first was the application of a least-squares criterion in matching the sum of Gaussian components with the experimental distributions curve; the second was the application of a procedure proposed by Morino which reduces the adverse effect of the arbitrary damping factor heretofore always used in computing the distribution function.

Another interpretational problem arises in the case of CF_3Br and CF_3I, which are molecules containing both light and heavy atoms. In this case the atomic scattering factors used in the interpretation of the data must be computed without the usual Born approximation which ignores the change of phase occurring in the scattering of electrons by different atoms. For these two molecules the scattering factors with and without the Born approximation are compared.

Small modifications in the treatment of internal rotations in gaseous molecules are also considered here.

A high-speed stored-program digital computer (IBM650) was tested as a computing aid for the many calculations involved in the manipulation of radial distribution and intensity functions. The trigonometric, exponential and certain polynomical functions which come up repeatedly in molecular structure investigations can be evaluated for any argument and to any degree of accuracy by expanding the function in an appropriate series and letting the computer evaluate the series. The least-squares method of analyzing composite peaks and the theoretical intensity calculation, including some types of internal rotations, have been programmed for the IBM650.

Theoretical intensities based on molecular models specified to 0.001A can now be calculated as required by the improved experimental data.

The structures of the molecules listed above have been obtained in terms of the positions of the maxima in the radial distribution functions and of the vibrational amplitudes for each internuclear pair. The results for the bonded distances and bond angles are:

CF_3Br - CF = 1.325 ± 0.005Å, CBr = 1.910 ± 0.006Å, ∠FCF = 109.2 ± 0.5°; CF_3I - CF = 1.332 ± 0.004Å; CI = 2.130 ± 0.008Å, ∠FCF = 108.3 ± 1°; CF_3CN - CF = 1.333 ± 0.005Å, CC = 1.495 ± 0.014Å, CN = 1.150 ± 0.010Å, ∠FCF = 108.5 ± 0.5°; CF_3SF_5 -CF = 1.330 ± 0.006A, SF = 1.571 ± 0.004Å, CS = 1.860 ± 0.015Å, ∠FCF = 108.7 ± 1°.

The CF distance in CF_3I is significantly larger than in CF_4 while those in CF_3Cl and CF_3Br have intermediate values. A curious new effect of fluorine substitution is observed for CH_3CN (and also in recent unpublished results for CH_3CHO). For both molecules the trifluoromethyl derivatives show CC distances which are 0.035A larger than in the parent molecules, an effect opposite to the decrease in CC distance observed with fluorine substitutions in all other organic compounds reported.

124 pages. $2.00.

THE USE OF THE NEUTRAL BIS-CYCLOPENTADIENYL METAL COMPOUNDS OF IRON, COBALT, AND NICKEL IN THE CATALYSIS OF HYDROGENATION REACTIONS

(L. C. Card No. Mic 58-2375)

Andrew Jackson Chadwell, Jr., Ph.D.
The University of Tennessee, 1958

Major Professor: Hilton A. Smith

The neutral bis-cyclopentadienyl metal compounds of iron, cobalt, and nickel were prepared and studied as possible sources of catalytically active iron, cobalt, and nickel. Nickelocene and cobaltocene are reduced to the free metal and cyclopentane in cyclohexane solution with hydrogen at 1000 psi. in the absence of a catalyst. The reduction of nickelocene takes place at 60°, and the reduction of cobaltocene occurs at 160-170°. Induction periods were observed. The hydrogen reduction of ferrocene was not achieved.

The hydrogenation of benzene to cyclohexane occurs above 60° on nickel added as nickelocene and above 120° on cobalt added as cobaltocene with hydrogen at pressures above 200-300 psi. The heterogeneous catalytic reactions are first order in hydrogen pressure and zero order in benzene concentration. Using the Variable Temperature Method, the apparent activation energies were determined at 130-170° with values of 8.78 and 19.85 kcal. $mole^{-1}$ being obtained for the reaction on nickel and cobalt, respectively. The catalysts formed by the in situ hydrogen reduction of nickelocene and cobaltocene are much less active than Raney nickel and have an activity comparable to Raney cobalt.

Acetone is hydrogenated to isopropanol on nickel from nickelocene. The reaction proceeds above 100° at hydrogen pressures above 100 psi. The reaction is first order in hydrogen pressure and zero order in acetone concentration. The apparent activation energy is 12 kcal. $mole^{-1}$ at 140-180°. Very little cobalt metal is produced by the hydrogen reduction of cobaltocene in acetone apparently because of compound formation between acetone and cobaltocene. The free metal which was produced exhibited catalytic activity.

Ethyl alurate undergoes hydrogenolysis on the nickel and cobalt catalysts above 250° at hydrogen pressures above 2000 psi. The principal products are dodecanol-1 and n-undecane with the latter being favored by long reaction times and high temperatures. The cobalt catalyst is more active than the nickel catalyst, and both are less active than copper chromite.

The hydrogenation of nitrobenzene and nitroethane on the nickel and cobalt produced by the hydrogen reduction of nickelocene and cobaltocene in situ leads to the formation of solid tar-like products. Considerable difficulty is experienced in reducing these metal compounds in the presence of the nitro compounds. Compound formation occurs when cyclohexene is treated with the bis-cyclopentadienyl compounds of iron, cobalt, and nickel thus preventing a study of the hydrogenation of cyclohexene in their presence.

Ferrocene acts as an inert material in all of the hydrogenation reactions attempted in its presence with the exception of a possible reaction with ethyl laurate at high temperatures. No evidence for the homogeneous activation of molecular hydrogen by ferrocene, cobaltocene, or nickelocene was obtained.

The hydrogen reduction of platinum(IV) chloride and chloroplatinic acid to platinum was investigated in ethanol solution. The reduction is inhibited by nitrobenzene, nitroethane, benzene, and cyclohexene when each is present in high concentrations. Evidence to confirm the existence of a platinum chloride-nitrobenzene compound in ethanol was not obtained. The homogeneous activation of molecular hydrogen by platinic chloride for the reduction of nitrobenzene was not observed.

A study of the properties of Raney cobalt catalyst was made. The catalyst has a dissolved hydrogen content of 40-70 standard milliliters per gram. Raney cobalt is active in catalyzing the hydrogenation of benzene about 120°, but it is less active than Raney nickel. Its surface area is 15.6 square meters per gram as determined by the chemisorption of behenic acid from benzene. The catalyst has an aluminum content of 3 per cent. 202 pages. $2.65.

ACTIVITY MEASUREMENTS IN POLYSTYRENE-CYCLOHEXANE SOLUTIONS NEAR THE THETA TEMPERATURE

(L. C. Card No. Mic 58-2293)

Douglas Oliver Geymer, Ph.D.
Duke University, 1958

Supervisor: Wm. R. Krigbaum

Solutions of macromolecules show large deviations from the ideal entropy of mixing. Two classes of theories have been advanced to account for these deviations. One class treats dilute solutions, and the other class treats concentrated solutions. The gap in the concentration range covered by these two classes is amenable to treatment only if the excluded volume of the polymer molecule

vanishes. The excluded volume is zero at the Flory theta temperature. It is therefore of interest to compare the activities predicted according to the two classes of treatments with those obtained by direct measurement at the Flory theta temperature for concentrations from zero to 100% polymer.

Cyclohexane solutions of fractionated polystyrene (polymerization initiated with benzoyl peroxide) were investigated in this study. Three fractions of polystyrene with viscosity-average molecular weights of 25,900, 72,000 and 557,000 were used. Activity of the cyclohexane was measured as a function of polymer concentration, polymer molecular weight, and temperature over a range of 20° centered about 34°C., the theta temperature for this system.

Osmotic pressures provided activity data at concentrations up to 25% polymer. Measurements were made in a brass block osmometer using never-dried cellulose films as membranes. For the more concentrated solutions the osmotic pressure was balanced by applying a known nitrogen pressure to the solution. A mercury differential manometer provided vapor pressures for concentrations over 50% polymer. In the intermediate concentration range vapor pressures were measured by isothermal distillation in thermostatted vacuum desiccators using triphenylmethane as a standard solute.

The osmotic pressure data show that the third virial coefficient is zero when the second virial coefficient is zero, but the fourth virial coefficient appears to be independent of temperature and is a large positive number increasing with increasing molecular weight. For solutions in which the volume fraction of polymer, v_2, is greater than 0.3, the activity of solvent is independent of polymer molecular weight for molecular weights greater than 25,000. The heat of dilution divided by v_2^2 increases with increasing concentration, slowly at first and then very rapidly at high concentrations.

Comparison of the free energy data with the Flory free energy equation for various values of the interaction parameter, χ, shows that the solution behaves more nearly ideally than predicted by theory. The entropy of dilution data compare more favorably with the Flory configurational entropy; however the agreement is still not good. The entropy of pair formation divided by v_2^2 increases from a constant negative value at low concentrations to positive values at high concentrations. The positive entropies of pair formation and the abnormally high heats of dilution at high concentrations may be due to association of the phenyl groups of polystyrene. None of the existing concentrated solution theories gives good agreement with experimental data.

In dilute solution the Flory-Krigbaum dilute solution theory gives fair agreement if the entropy parameter, ψ_1, is given the value 0.21. The agreement would be very good if the quantity X were $7(\alpha^2 - 1)$ rather than $2(\alpha^2 - 1)$, where α is the molecular expansion factor as determined viscometrically.

In the intermediate region where neither class of treatment normally holds, the dilute solution equations fit the data better than the concentrated solution equations.

81 pages. $2.00.

THE TERNARY SYSTEM MgO-MnO-SiO_2

(L. C. Card No. Mic 58-2260)

Frederick Paul Glasser, Ph.D.
The Pennsylvania State University, 1958

The phase diagram for the MgO-MnO-SiO_2 system has been determined by the quenching technique. By working in an atmosphere of controlled oxygen pressure, manganese was maintained in the divalent state. The oxidation state was checked by chemical analysis of representative charges.

Equilibrium diagrams are presented for the ternary system showing liquidus relationships and three phase boundaries. Phase equilibrium relationships along three joins --MnO-SiO_2, $MgSiO_3$-$MnSiO_3$, and Mg_2SiO_4-Mn_2SiO_4-- have also been determined.

In the limiting binary system MnO-SiO_2 two manganese silicates, $MnSiO_3$ and Mn_2SiO_4 are formed. $MnSiO_3$ melts incongruently to tridymite and liquid at 1291°C, Mn_2SiO_4 melts congruently at 1345°C. These compounds are identical with the natural minerals rhodonite and tephroite. A eutectic between $MnSiO_3$ and Mn_2SiO_4 is located at 38.3 wt. % SiO_2 and 1251°C; also between Mn_2SiO_4 and MnO at 25.5 wt. % SiO_2 and 1317°C. A large region of liquid immiscibility covers the region between 55-99 wt. % SiO_2.

The Mg_2SiO_4-Mn_2SiO_4 join exhibits continuous solid solution between the two end members. Liquidus temperatures rise regularly from 1345°C to 1890°C, the melting point of Mg_2SiO_4.

$MgSiO_3$ and $MnSiO_3$ are not completely miscible in the solid state. Two series of solid solutions are formed at high temperatures. One is a triclinic series based on the rhodonite structure, the other based on the high enstatite (monoclinic ?) structure. The triclinic rhodonite structure extends to 94.5% $MgSiO_3$ at 1538°C. At lower temperatures the solubility of $MgSiO_3$ in rhodonite is less. At 1300°C the maximum rhodonite solid solution contains only 78% $MgSiO_3$. The other solid solution is presumably a protoenstatite-like solid solution. However compositions containing over 5% $MnSiO_3$ can be quenched to two new forms of enstatite solid solution. These are identified by x-ray powder patterns. One of these new forms of enstatite has been discovered in the silicate phase of stony meteorites. These forms have not been produced from pure $MgSiO_3$, indicating that the polymorphism of enstatite is further complicated by solid solution phenomena.

Liquidus temperatures rise regularly from 1308°C at 85.5% $MnSiO_3$ to 1533°C at 13% $MnSiO_3$. Metasilicates richer or poorer than these compositions melt incongruently, yielding silica or olivine respectively as primary phases.

The diagram of the ternary system is dominated by three bands representing extensive solid solution series which extend across the ternary system from the MgO-SiO_2 side to the MnO-SiO_2 side. The metasilicate band forms a trough of low liquidus temperatures between the higher liquidus band of olivines and the large region of immiscible liquids which dominates the silica apex region. In general, liquidus temperatures fall rapidly toward the MnO-SiO_2 side.

106 pages. $2.00.

A STUDY OF THERMODYNAMIC PROPERTIES OF ELECTROLYTIC SOLUTIONS OF RARE EARTHS

(L. C. Card No. Mic 58-2186)

David Judson Heiser, Ph.D.
Iowa State College, 1958

Supervisor: Frank H. Spedding

Electrical conductances, cation transference numbers, osmotic coefficients, and activity coefficients have been determined for several rare-earth nitrates in aqueous solution. Solutions of the rare-earth nitrates were prepared by dissolving the purified oxide in slightly less than an equivalent amount of c.p. nitric acid. The filtered solution of a given salt was adjusted to the stoichiometric pH, the value of which was established by a series of titrations. Resistance measurements for the electrolytic conductances were made with a Jones conductivity bridge at alternating current frequencies of 1000 and 2000 cycles. Specific and equivalent conductances in the range 0.0001 to 0.1 Normal have been tabulated for the nitrates of samarium, holmium, erbium, and ytterbium. It was found that the equivalent conductances at infinite dilution for these salts decrease with increasing atomic number of the cation. Values of the individual rare-earth ionic equivalent conductances at infinite dilution agreed well with the results obtained by other investigators for other salts of the same cations. Transference numbers in the range 0.01 to 0.1 Normal were determined by the moving boundary method. Values corrected for volume changes in the cell and for solvent-conductance were found to be slightly higher for $Sm(NO_3)_3$ than for the other salts.

Osmotic coefficients in the range 0.1 to 1.6 molal were determined for lanthanum chloride, and for samarium, holmium, erbium, and ytterbium nitrates by the method of isopiestic comparisons. Potassium chloride was used as the reference electrolyte. Results for $LaCl_3$ agreed with those of Mason (C. M. Mason, J. Am. Chem. Soc. 60, 1638 (1938)) within 0.1% for concentrations above 0.6 molal, but deviated from Mason's values an average of 0.5% in the lower concentration range. Molal activity coefficients were calculated for the rare-earth nitrates in the forms $[\log(\gamma_{0.04}) - \log(\gamma_m)]$ and $[\log(\gamma_{0.1}) - \log(\gamma_m)]$ in which reference values for the activity coefficients at 0.04 or 0.1 molal could be substituted to compute the activity coefficients at molality m. Values of the Debye-Hückel distance-of-closest-approach parameters were estimated from conductance data for the four nitrates studied. These were used to compute Debye-Hückel activity coefficients for very dilute solutions. The Debye-Hückel calculations provided reference values from which sets of activity coefficients at round concentrations up to 1.6 molal were computed for the four rare-earth nitrates. Special features in the data with regard to salts of holmium were discussed. These show that phenomena involving the rare-earth elements can be quite complex. 179 pages. $2.35.

HYDRODYNAMIC VOLTAMMETRY

(L. C. Card No. Mic 58-2261)

Richard Anthony Javick, Ph.D.
The Pennsylvania State University, 1958

A voltammetric study of current-voltage curves was made at a conical platinum microelectrode in flowing solutions. A circulatory electrolysis cell assembly with judiciously controlled hydrodynamic characteristics has been developed. In this apparatus the velocity of flow of the electrolytic solution was varied between 25 and 700 cm./sec. Limiting currents were controlled by mass transfer which depended on diffusion and forced convection in accordance with the following equation:

$$i_l = \frac{4}{3\sqrt{3}} nFAC\, D^{2/3}\, v^{1/2}\, L^{-1/2}\, \nu^{-1/6}$$

where i_l is the limiting current, nF denotes the number of coulombs per mole, A is the effective area of the conical indicator electrode, C denotes the concentration and D the diffusion coefficient of the reacting species, v is the flow velocity of the solution past the indicator electrode surface, L is the slant height of the cone and ν is the kinematic viscosity of the solution. The above equation has been derived for conditions of laminar flow with the aid of dimensional analysis by adapting to mass transfer a rigorous heat transfer expression. Evidence has been obtained that the random current fluctuations normally observed at solid indicator electrodes in flowing and/or stirred solutions were due to turbulence. Limiting currents free of turbulent fluctuations were obtained in a specially designed gravitational flow tube which approximated the behavior of a quasi-wall-less electrolysis cell.

The reduction of oxygen in flowing solutions at the conical platinum microelectrode was found to involve a four-electron stoichiometry which is accounted for by the following reaction sequence:

$$O_2 + e^- \longrightarrow O_2^- \longrightarrow O_2^- + e^- + 2H^+ \longrightarrow H_2O_2$$
$$O_2 + e^- \longrightarrow O_2^- \longrightarrow O_2^- + H_2O_2 \longrightarrow OH^* + O_2 + OH^-$$
$$OH^* + e^- \longrightarrow OH^-$$

The ascending portions of the current-voltage waves of aquo ferric ion in perchloric acid were irreversible in shape, the relevant current being controlled by the rate of mass transfer as well as by electron transfer. The processes

$$Fe(III) + e^- \xrightarrow{k_{Red}} Fe(II)$$

$$Fe(II) \xrightarrow{k_{Ox}} Fe(III) + e^-$$

had first order kinetics in agreement with the absolute rate theory. At the standard potential ($E^0 = 0.771$ volt versus normal hydrogen electrode) of the aquo ferric-ferrous couple, the specific rate constant was determined as $k^0_{Ox} = k^0_{Red} = [1.1 \pm 0.2] \times 10^{-2}$ cm./sec. The following reaction mechanism was postulated accordingly for the electroreduction of ferric ion:

$$[Fe(H_2O)_6]^{3+} + (e)\ Pt \longrightarrow [Fe(H_2O)_5\, e \ldots Pt]^{2+} \longrightarrow [Fe(H_2O)_6]^{3+} + Pt$$

Aquo Ferric Ion | Charged Cathode Site | Activated Complex | Aquo Ferric Ion | Discharged Cathode Site

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The electrooxidation of iodide

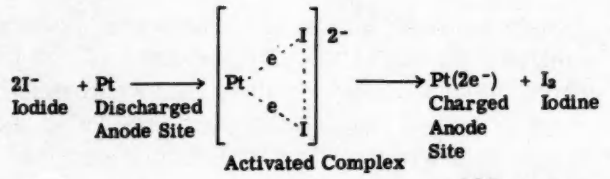
$$2I^- \xrightarrow{k^{m0}_{Ox}} I_2 + 2e^-$$

was found to be second order, while the converse process

$$I_2 + 2e^- \xrightarrow{k'_{Red}} 2I^-$$

obeyed first order kinetics. Based on these premises a wave equation was derived applicable to the current-voltage curves of iodide at the conical platinum microelectrode in flowing solutions. The specific rate constants at the standard potential of 0.6197V versus normal hydrogen electrode were evaluated as $k^{m0}_{Ox} = \overline{[3 \pm 1]} \times 10^{-2}$ cm.^{4}/mole sec. and $k^{0}_{Red} = [6 \pm 2] \times 10^{+1}$ cm./sec.

The corresponding reaction mechanism was postulated to be



122 pages. $2.00.

CHARACTERISTIC GROUP VIBRATIONS

(L. C. Card No. Mic 58-1155)

William Travers King, III, Ph.D.
University of Minnesota, 1956

Many complex molecules contain "characteristic groups," such as CH_3 or NH_2, whose group frequencies and vibrational modes are reasonably well known in advance of calculation. A method is desirable whereby these "group" vibrations may be eliminated from the vibrational problem once and for all, in advance, and whereby the reduced problem of "framework" vibrations may be simply written down without considering the complete molecular problem first. Such a method would be quite useful in proposing vibrational assignments and in the initial attack upon the normal-coordinate treatment for molecules containing "characteristic groups."

This thesis presents such a method. Since characteristic group vibrations are observed to be approximately independent of the nature of the molecular framework to which the group is bonded, a simple, conveniently defined "standard" molecule for the group is chosen and the normal coordinates for the characteristic modes are computed. These characteristic normal coordinates are used first to obtain an approximate general expression for the characteristic group frequencies in any molecule of interest containing the group and second, to construct an orthogonal coordinate transformation that factors the characteristic frequencies and group coordinates from the vibrational problem. By further bold approximation the adjustments that are introduced into the reduced problem by the coordinate transformation and the removal of the characteristic modes are tucked into the masses of the group atoms thereby defining effective values for them. The reduced problem for "framework" vibrations is then derived by the usual methods from the reduced set of valence (symmetry) coordinates describing the "framework" displacements and the adjusted group masses. Further, a simple prescription is given by which approximate normal coordinates for the complete problem can be constructed from normal coordinates for the reduced "framework" problem.

The characteristic vibrations of the CH_3, CD_3, CH_2, CD_2, OH, OD, NH_2 and ND_2 groups are analyzed and effective masses for them are determined. The results of these analyses are then used to carry out approximate normal-coordinate treatments for propane, several tetramethyl compounds, methyl alcohol and methylamine. Much of the information obtained about methyl group vibrations in these molecules is summarized in two empirical formulae: one relates the H-C-X valence-bond bending force constant in the CH_3-X fragment of the molecules to a single parameter determined from the electronegativity of the X atom and the C-X bond length, while the second relates the frequency of the symmetrical, "umbrella," methyl group deformation mode also to this parameter. 258 pages. $3.35.

ACID DISSOCIATION CONSTANTS OF SOME HYDROXYANTHRAQUINONES

(L. C. Card No. Mic 58-2262)

Herbert Daniel Kivlighn, Jr., Ph.D.
The Pennsylvania State University, 1958

The main purpose of this investigation is the determination of the primary and secondary thermodynamic acid dissociation constants of the following weak acids: 1-hydroxy-, 2-hydroxy-, 1,2-dihydroxy-, 1,3-dihydroxy-, 1,4-dihydroxy-, 1.5-dihydroxy-, 1,8-dihydroxy, 2,6-dihydroxyanthraquinone. A 70% dioxane - 30% water, by weight, solution is employed as the solvent. The possible correlations between acid strength and the position of the hydroxyl group in the respective hydroxyanthraquinone isomers are also investigated.

The data required for the evaluation of these dissociation constants were obtained by the use of buffered cells without liquid junctions. A modified version of the conventional potentiometric apparatus for measuring EMF values was employed during this project. In addition to the conventional EMF equipment, an amplifier was necessary to overcome the large resistance which resulted when a glass electrode was used in place of a hydrogen electrode.

The buffered cells were prepared by half neutralizing a known weight of weak acid with tetramethylammonium hydroxide. In order to permit the EMF measurements on the cell to be made, tetramethylammonium chloride also was added to the weak acid buffer solutions. Weight dilutions were performed on these original stock solutions.

Primary and secondary thermodynamic acid dissociation constants, expressed as pKa's, are established for the previously mentioned compounds. A correlation between acid strength and intramolecular hydrogen bonding is presented. The effect of this type of hydrogen bond is indicated as a possible explanation for the acid strength differences found between the compounds investigated.

132 pages. $2.00.

THE SYSTEM Mn-O-OH

(L. C. Card No. Mic 58-2263)

Cyrus Klingsberg, Ph.D.
The Pennsylvania State University, 1958

This study is concerned with the application of new experimental conditions and new techniques to the formation, stability, and interconvertibility of the minerals in the Mn-O-OH system. Specifically, this involves:

1. A study of the formation and stability of various phases in the system in the presence of high oxygen or water pressure.
2. The control of oxidizing and reducing conditions by varying the partial pressures of oxygen under hydrothermal conditions.

Familiar hydrothermal techniques were used throughout this investigation. However, what is believed to be an innovation in hydrothermal research is the introduction of oxygen under controlled pressure to a bomb for the purpose of influencing the oxidation state of the cation under examination. For this purpose, commercially purchased tank oxygen was delivered to the bombs by stainless steel tubing that operated in parallel to the water line and was kept separate from the water line by means of appropriate valves. It was found possible to work quickly and easily at oxygen pressures up to 3,000 psi., water pressures up to 50,000, and temperatures to 1,000°C.

The major results of this investigation include:

1. Equilibrium pressures of oxygen as a function of temperature have been determined for the reactions: pyrolusite $\rightleftharpoons$ bixbyite + O_2 and bixbyite $\rightleftharpoons$ hausmannite + O_2. In both cases there is considerable change from older data.
2. Equilibrium pressures of water as a function of temperature have been determined for the reactions: pyrochroite $\rightleftharpoons$ manganosite + H_2O and manganite $\rightleftharpoons$ bixbyite + H_2O.
3. Two new phases were discovered. The first, tentatively named "Manganoxide" is an anhydrous orthohombic form that is thought to be a polymorph of Mn_3O_4. The second, tentatively named "G-R," is intermediate in composition between groutite and ramsdellite and is isomorphous with both.
4. The interconvertibility of manganite $\rightleftharpoons$ pyrolusite and groutite $\rightleftharpoons$ ramsdellite has been described.
5. The maximum temperatures of stability in air for a variety of minerals has been reported.
6. Improved x-ray data for synthetic pyrochroite and synthetic hausmannite have been provided.
7. X-ray evidence for complete absence of solid solution has been reported for the anhydrous oxides in equilibrium with each other at low temperatures (at 900°C). The same is true for relations between the various hydrous and anhydrous oxides. The criterion of solid solution, the shift in x-ray spacings, is not unequivocal in certain cases, but its absence in so many cases must be viewed with some concern. 164 pages. $2.15.

APPLICATIONS OF THE EFFECTS OF BORIC AND NITROUS ACID ON THE ULTRAVIOLET ABSORPTION SPECTRA OF ORGANIC COMPOUNDS

(Publication No. 18,857)

Donald Francis Kuemmel, Ph.D.
Purdue University, 1956

Major Professor: M. G. Mellon

The effect of boric acid on the ultraviolet absorption spectra of organic polyhydroxy compounds was investigated, with possible analytical applications in mind. Boric acid was found to have little or no effect upon the ultraviolet spectra in aqueous or ethanol solution of a majority of the aliphatic and aromatic polyhydroxy compounds investigated. The negative results obtained are indicative of negligible formation of the usual type of complex attributed to boric acid in the presence of polyhydroxy compounds.

4,5-Dihydroxy-2,7-naphthalenedisulfonic acid (chromotropic acid) was a noteworthy exception to the above results. A large hypsochromic shift in the ultraviolet spectrum of this reagent occurs in aqueous solution in the pH range 6.5 to 10.0 upon the addition of boric acid. The shift occurs readily in aqueous solutions, but not to any great extent in absolute ethanol. As a result of the shift, the system decreases in absorbancy in the 355 to 380 mμ region, the maximum decrease occurring at 361.5 mμ. An absorptimetric method for determining up to 2.4 ppm. boron in aqueous solution was developed utilizing the absorbancy decrease at 361.5 mμ. Calibration of the spectrophotometer is mandatory, since the system does not follow Beer's law.

The ultraviolet spectra of two complexes isolated from the pyrocatechol-boric acid-pyridine system were used to resolve conflicting reports in the literature on the composition of the complexes. These spectra also indicated that the complexes are completely dissociated into their constituents (pyrocatechol, boric acid, and pyridine) in absolute ethanol solution.

The effect of nitrous acid on the ultraviolet absorption spectra of over 100 aromatic amines was studied in order to find reagents suitable for the absorptimetric determination of nitrite ion. para-Phenylenediamine and many of its derivatives proved to be extremely sensitive toward nitrite ion. The diazonium compounds formed from these reagents absorb strongly in the 330 to 400 mμ region, where a majority of the para-phenylenediamines themselves show negligible absorption. The sensitivity of these reagents toward nitrite ion is comparable to that of existing colorimetric methods, the molar absorbancy indices of the diazonium salts being in the 33,000 to 40,000 range. Beer's law is followed by a majority of the systems in the range 0 to 1.2 ppm. of nitrite ion. The chloro-para-phenylenediamine system was singled out for thorough investigation of reproducibility, reagent stability, and interference effects.

An attempted correlation of the ultraviolet spectra of diazonium compounds formed from monosubstituted anilines with Hammett's substituent constants for the corresponding groups was unsuccessful. Although diazonium compounds having electron-donor groups in the para-position give more intense absorption maxima at longer

wavelengths, no relationship could be established to which a majority of the data would conform.

224 pages. $2.90. Mic 58-5041

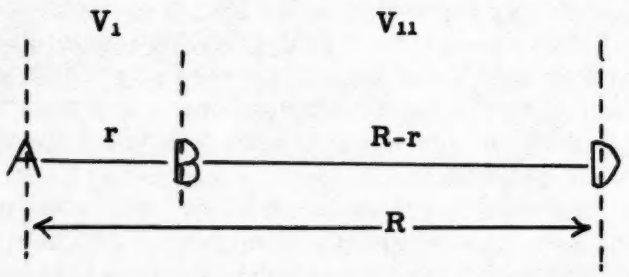
THE CALCULATION OF THE ENERGY OF ACTIVATION FOR SOME SIMPLE REACTIONS

(L. C. Card No. Mic 58-2218)

Asa Leifer, Ph.D.
University of Maryland, 1958

Supervisor: Professor Ellis R. Lippincott

In order to calculate the energy of activation for some simple reactions the following scheme was used. Consider the reaction between a molecule AB and an atom D. The coordinates for this system are given in the following diagram.



There are two attractive potentials which must be considered. They are

$$1 \quad V_1 = D_o(AB)\left\{1 - \exp\left(-n(AB)\left[r - r_o(AB)\right]^2/2r\right)\right\}$$

$$2 \quad V_{11} = D_o(BD)\left\{1 - \exp\left(-n(BD)\left[R-r-r_o(BD)\right]^2/2(R-r)\right)\right\},$$

where $r_o(AB)$ and $r_o(BD)$ represent the bond equilibrium distances of the molecules AB and BD, respectively, $D_o(AB)$ and $D_o(BD)$ represent the gound state dissociation energies of the corresponding molecules, and finally n(AB) and n(BD) are constants.

There is a repulsion set up between the atom D and the molecule AB. This repulsion was derived from a delta-function model and is given by

$$3 \quad V_{rep.} = 2B \exp(-ca) .$$

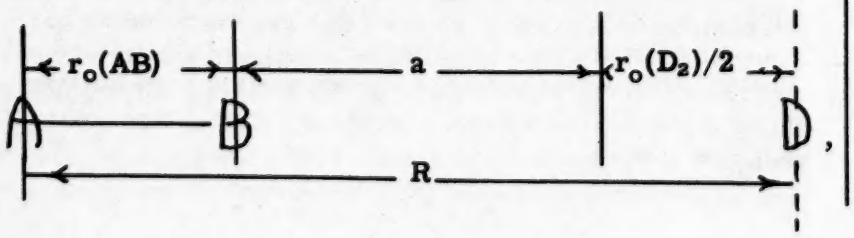
The terms B and c are constants dependent upon the separated atom energy of the system while a represents the delta-function spacing. The values of c and B are given by

$$4 \quad c = \sqrt{(I/I_o)_A + (I/I_o)_B + (I/I_o)_D}\ c(H_2^+)$$

and

$$5 \quad B = \left[(I/I_o)_A + (I/I_o)_B + (I/I_o)_D\right] I_H ,$$

where I represents the ionization potential of the atom in question and the corresponding I_o represents the ionization potential of the element in the same row first column of the periodic chart. The value of $c(H_2^+)$ is 1.89×10^8 cm^{-1}.



The delta-function spacing for this reaction is illustrated in the preceding diagram, and

$$6 \quad a = R - r_o(AB) - r_o(D_2)/2 ,$$

where a is calculated on the basis that the repulsion interaction takes place between the two nearest delta-functions. Using 4, 5, and 6 in equation 3 allows one to calculate the repulsion energy.

The total energy of the system is then given by

$$7 \quad V = V_1 + V_{11} + V_{rep.} .$$

There are two possible ways of calculating the energy of activation. The first one involves a plot of V (calculated from equation 7) vs. r equal to $r_{max.}$ ($r_{max.}$ represents the top of the energy barrier). The minimum in the curve gives the energy of activation for the reaction. This is because the system will always follow the path of least energy. The second method involves the use of the equation r = bR, where b is a constant. The procedure is then to choose a value of b and calculate the energy (from 7) for various values of R. A plot of these results gives a curve which has a minimum. The process is then repeated for various values of b. At the start of the reaction $R \longrightarrow \infty$ and $r = r_o(AB)$, thus V = O. At the end of the reaction $R \longrightarrow \infty$ and $r \longrightarrow \infty$ and so $V = D_o(AB) - D_o(BD)$. Using the above results one can obtained potential energy curve corresponding to the most probable path that the reaction will follow. From this plot the energy of activation can be obtained. It should be mentioned here that D_o, the ground state dissociation energy of the molecule, is used in order to obtain a correction for the zero-point energy of the system. This is because the experimental value is generally quoted with reference to the initial ground state of the molecule.

Employing the first method to the ortho-para hydrogen reaction the energy of activation is found to be 8.5 kcalories. The experimental value is 6-9 kcalories. This method also indicates that a complex should be found. However it is located at a minimum in the potential energy curve and the energy of stability is -1.43 kcalories.

The method was then applied to reactions of the type

$$H_2 + X \longrightarrow HX + H,$$

where X represents Cl, Br, or I. The energies of activation calculated for the forward and reverse cases agree closely with the experimental values.

For reactions of the type

$$X_2 + H \longrightarrow HX + X$$

(X represents one of the halogens listed above) the method yields poor results. This indicates that the method apparently has limited applicability. 154 pages. $2.05.

BRITTLE-DUCTILE TRANSITION IN VANADIUM

(L. C. Card No. Mic 58-2193)

Benny Allen Loomis, Ph.D.
Iowa State College, 1958

Supervisor: Dr. O. Norman Carlson

Mechanical tests have been made on two grades of vanadium over a range of temperatures below 25°C to establish the existence of a brittle-ductile transition and the temperture range over which it occurs. Also, the effect of small amounts of metallic and non-metallic additions on the brittle-ductile transition in vanadium has been determined. Some of the physical properties of vanadium have been determined through the transition temperature. The results and conclusions of this investigation are summarized as follows:

1. There is a brittle-ductile transition in vanadium of 99.85 per cent purity at $-65^{0} \pm 10^{0}$C. The transition occurs at the lower temperature of $-110^{0} \pm 10^{0}$C in vanadium of 99.95 per cent purity. Both grades of vanadium regain some ductility at temperatures below -140°C.
2. Small amounts of chromium, molybdenum, tantalum, zirconium, titanium, and thorium, when added to vanadium, have anomalous maxima and minima effects on the transition temperature of vanadium. The only metallic additions which lower the transition temperature of vanadium are titanium when present in amounts of 2.5 weight per cent or greater and possibly throium when present in amounts less than one weight per cent.
3. The effect of adding small amounts of either hydrogen, oxygen, nitrogen, or carbon to vanadium is to raise the transition temperature. Hydrogen is the most effective in raising the transition temperature and carbon is the least effective. Oxygen and nitrogen have an effect intermediate to that of hydrogen and carbon.
4. The brittle-ductile transition in vanadium is apparently due to the interaction of dislocations with minute amounts of the interstitial solute atoms hydrogen, oxygen, nitrogen, or carbon. It is postulated that the transition in vanadium is accentuated by hydrogen atoms or ions assuming ordered positions in the vanadium lattice at temperatures below -65°C. This conclusion is based on the change of physical properties of vanadium near the transition temperature. There was no evidence for a low-temperature allotropic transformation in vanadium.

101 pages. $2.00.

THE HIGH TEMPERATURE HEAT CAPACITY AND RELATED THERMODYNAMIC FUNCTIONS OF SOME RARE EARTH METALS

(L. C. Card No. Mic 58-2194)

James John McKeown, Ph.D.
Iowa State College, 1958

Supervisor: Adrian H. Daane

A Bunsen ice calorimeter and high temperature furnace have been designed and constructed; modifications introduced in the design are described in detail. The enthalpy of α-Al_2O_3 was determined at 100-degree intervals from 0°C to 1100°C. These data are compared with the data of the National Bureau of Standards at the temperatures of measurement.

The high temperature enthalpies of cerium, praseodymium, neodymium and samarium were measured. Equations which express the thermodynamic quantities as a function of temperature are given. The data are tabulated at 50-degree intervals for cerium, neodymium and samarium from 0°C to 1100°C and for praseodymium from 0°C to 800°C. The enthalpies and entropies of transition are given for cerium, praseodymium, neodymium and samarium and the enthalpies and entropies of fusion for cerium, neodymium and samarium.

The theoretical contributions to the heat capacities are calculated and compared with the measured values at 1000°K. The significance of the entropies of transition and fusion are discussed for the metals studied.

113 pages. $2.00.

STABILITY STUDIES OF THE ZIRCON-THORITE GROUP AND THE EFFECT OF RELATED OXIDES

(L. C. Card No. Mic 58-2264)

Frederick Albert Mumpton, Ph.D.
The Pennsylvania State University, 1958

The stability relations among the minerals of the zirconthorite group and the effect of related oxides on them have been studied under both "dry" and hydrothermal conditions. The monoclinic-to-tetragonal inversion in "pure" ZrO_2 has been located at $1170^{0} = 15^{0}$C. The problem of "hydrous" zircons and its relation to the metamict state has been investigated both experimentally and theoretically, as have the phase equilibria involved in the polymorphism of $ThSiO_4$.

The systems ZrO_2-ThO_2, ZrO_2-UO_2 and ThO_2-UO_2 have been studied at subsolidus temperatures between 300°C and 1400°C and the limits of stable and metastable solid solution have been delineated. The Alchemade triangles in the ternary systems ZrO_2-ThO_2-SiO_2 and ZrO_2-UO_2-SiO_2 have been determined and not-impossible diagrams are presented for the systems ZrO_2-UO_2-O, ThO_2-UO_2-O and ThO_2-UO_2-SiO_2. The extent of solid solution between $ZrSiO_4$-$ThSiO_4$, $ZrSiO_4$-"$USiO_4$" and $ThSiO_4$-"$USiO_4$" is discussed in connection with the composition of natural zircon, thorite, uraninite, thorianite and baddeleyite.

The limitations of experimental studies of systems

involving oxides and silicates of the heavy tetravalent elements are outlined with emphasis on the metastable equilibrium and oxidation-reduction reactions which are encountered. The application of experimental data to natural mineral assemblages is discussed. 117 pages. $2.00.

A STUDY OF THE KINETICS OF SOME FORMATION AND ISOTOPE EXCHANGE REACTIONS INVOLVING THE CHLORINE FLUORIDES

(L. C. Card No. Mic 58-2431)

James Parkhurst Phelps, Ph.D.
Michigan State University, 1956

Equipment and procedures for studying the kinetics of formation reactions as well as isotope exchange reactions of gaseous halogen fluorides have been developed.

The kinetics of the formation of chlorine monofluoride from chlorine and chlorine trifluoride were studied in the temperature range 180° C. to 240° C. The reaction was found to follow second-order kinetics, with an activation energy of 21.8 ± 1 kcal./mole and an activation entropy of -8.8 ± 1 e.u. The reaction was postulated to proceed through a molecular complex.

Qualitatively, chlorine exchange between chlorine trifluoride and chlorine occurred in the temperature range 180° C. to 255° C., but did not occur between reactants in the gas phase at room temperature nor between reactants in the liquid phase at about -50° C.

The kinetics of chlorine exchange between chlorine trifluoride and chlorine monofluoride were studied in the temperature range 203° C. to 245° C. Although the data do not uniquely determine the mechanism, they indicate that exchange proceeds primarily by a homogeneous mechanism such that the rate of exchange is proportional to the square roots of reactant concentrations. The activation energy for the exchange was found to be 15.9 ± 1 kcal./mole, and the activation entropy was -46 ± 1 e.u.

Chlorine exchange between chlorine monofluoride and chlorine was found to take place at room temperature. Exchange was postulated to proceed through a molecular complex. 162 paves. $2.15.

THE RECOMBINATION OF IODINE ATOMS IN NON-POLAR SOLVENTS

(L. C. Card No. Mic 58-2474)

Howard Rosman, Ph.D.
Columbia University, 1958

In the liquid phase, two iodine atoms recombine after having diffused into the same solvent cage. The excess kinetic energy will be rapidly dissipated to the surrounding solvent molecules which act as third bodies.

If we assume that two atoms will recombine as soon as they have encountered one another, the rate of association in solution depends upon the diffusion rate of the reacting species.

Several previous workers have determined values for the specific rate constant for recombination of iodine atoms in hexane and in carbon tetrachloride at 25°C.

In order to determine the effect of varying solvent and temperature on the specific rate constant for iodine atom recombination, k_4, it was necessary to know the lifetime of iodine atoms, τ, the rate at which iodine molecules absorb light, q_a, and finally the primary quantum yield for the photo-dissociation of iodine molecules, ϕ.

Lampe and Noyes, using a scavanger technique, (F. W. Lampe and R. M. Noyes, J. Am. Chem. Soc., 76, 2140, 1954) determined the primary quantum yields for iodine in hexane, carbon tetrachloride and hexachlorobutadiene-1,3. Their measurements were made at a number of temperatures in each solvent.

In order to make use of the Lampe data, the mean lifetime of iodine atoms and the rates of light absorption by molecular iodine were determined in the same solvents and at the same temperatures that were used to measure primary quantum yields.

The mean lifetimes were measured by applying a rotating sector technique to the photochemical exchange reaction between iodine and trans-diiodoethylene. The reaction, which is first order in iodine atoms, was followed under conditions of continuous and intermittent light. The various rates of exchange were used to calculate the average lifetimes of iodine atoms.

The calculated rate constants for the recombination reaction, lie in the range between 4×10^9 and 1.5×10^{10} liter/mole sec. and decrease as the viscosity of the solvent increases. These values are of the magnitude to be expected, if the rates of the reaction were determined by the rate at which atoms diffuse together.

The k_4 values were also found to be in good agreement with those previously found in other laboratories.

In a review of the methods available in studying photostationary systems, it may be concluded that the best available techniques are those for measuring primary quantum yields, lifetimes and recombination rate constants.

Primary quantum yields are the simplest to obtain, using a scavenger technique, and therefore by measuring either the lifetime or recombination rate constant, a complete description of a photo-stationary system may be made. 113 pages. $2.00.

THE OPTIMUM CONCENTRATION EFFECT IN RAMAN SPECTROSCOPY

(L. C. Card No. Mic 58-2222)

John Philip Sibilia, Ph.D.
University of Maryland, 1958

Supervisor: Ellis R. Lippincott

The optimum concentration technique for increasing the intensity of the Raman spectrum of a colored substance has been considered in detail. Intensity-concentration data are given for the 1651 $cm.^{-1}$ and 3003 $cm.^{-1}$ lines of cyclooctatetraene and the 1350 $cm.^{-1}$ and 1610 $cm.^{-1}$ lines of 4,6-dinitro-o-cresol using Hg 4358 Å excitation. An optimum concentration for a maximum in observed Raman intensity is shown to exist for each of the Raman lines

examined. The curve maxima show a significant shift to higher concentrations when a sample tube of smaller diameter is used.

An expression has been derived relating the observed Raman intensity with the molar concentration of a solution of the absorbing substance in a transparent solvent. The expression is derived by consideration of the absorption of both the exciting radiation and the scattered radiation.

The agreement between the theoretical curves and the experimental points is good. More experimental data are necessary to further check the theoretical expression. However, the number of compounds which will show the optimum concentration effect with blue light is limited due to their photochemical instability.

The best technique for obtaining the Raman spectra of colored substances is to use excitation radiation which will not be absorbed. When light sources which emit such radiation are not available, the optimum-concentration technique has been shown to be a possible alternative method for obtaining a Raman spectrum. 112 pages. $2.00.

ECONOMICS, GENERAL

THE DISTRIBUTION AND RELATIVE STRENGTH OF THE PROVINCIAL MERCHANT GROUPS IN CHINA, 1842-1911

(L. C. Card No. Mic 58-2134)

Peng Chang, Ph.D.
University of Washington, 1958

The provincial merchant groups are a key to the understanding of China's commerce, not only because they were one of the most important merchant organizations, but also because they provided a very rewarding source of the geographical, economic and historical backgrounds of the more important merchants in China.

During the period of 1842 - 1911, there were six leading provincial merchant groups in China, namely, Kwangtung, Fukien, Shansi, Kiangsi, Anhwei and Chekiang. They were considered to have been leading groups because of the following facts: 1) they were found in many cities and towns all over the country, 2) they possessed a pre-eminent, if not commanding position in important commercial centers, and 3) they succeeded in controlling, partly at least, the commerce of their own provinces.

The forces that helped make them leaders in the commerce of China were numerous. Basically, it was the necessity for trade of their provinces with other provinces or countries that induced them to embark upon commerce. They may be evidenced by the fact that the home provinces of all the six leading groups were in need of importing either rice or cotton and cotton goods, or both, from other parts of the country or from abroad. On the other hand, they all had some special products and/or services for exportation. This factor alone, however, could not sufficiently account for their success, for the same needs in other provinces had failed to produce a strong merchant group. A more important factor was that they also had, because of location, government policies or other reasons, a very large share in the most profitable business or businesses of the time. Before the 19th century, the most profitable businesses in China were the salt and the Mongolian trade, the former having been mainly in the hands of the Anhwei and the Shansi Group, and the latter having been controlled by the Shansi Group only. This explains why the Anhwei and the Shansi Group had long been the leading merchants. After the opening of China, the most profitable business was trading with the West, which was largely in the hands of the Kwangtung and the Chekiang Group. This explains why these two groups were rapidly becoming the new leaders in commercial China. The Fukien Group, to a lesser degree, was also benefited by its early contact with the West. Only the Kiangsi Group, which did not have a substantial share in the above mentioned businesses, was an exception, but the Kiangsi Group had never been the most important group and its importance was on the decline after the foreign trade center was moved from Canton to Shanghai.

A favorable position in foreign trade, therefore, was a decisive factor in determining the relative strength of the different provincial merchant groups in China during the period of 1842 - 1911. This was most clearly indicated by the fact that the Anhwei, Shansi and Kiangsi groups, all of which were inland groups and had no close contact with the West, were on the decline, while the Kwangtung, Fukien and Chekiang groups, all of which were coastal groups and had been benefited by foreign trade, were on the rise. If a comparison is made with similar situations in Europe, it will be found that the same factor was very important to the rise of such famous merchant groups as the Venetian Merchants and the Hanse. Inferentially, this means that foreign trade was a very strong stimulus to commerce, the lack of which might be one of the most important causes of the retardiness of the economic development of China prior to the period under study. 217 pages. $2.85.

FACTORS AFFECTING ECONOMIC GROWTH IN FRANCE: 1913-1938

(L. C. Card No. Mic 58-1701)

Charles Hammond, Jr., Ph.D.
University of Illinois, 1958

Because of the importance of economic growth in all countries today, the purpose of this thesis was to describe and evaluate several factors that seemed important as causal elements affecting French economic growth during the interwar years. France was selected for study for two main reasons. First, it represented a country which had once occupied a leading industrial position, but had been declining for over a century; and secondly, some of the factors to be studied seemed more prevalent in France.

Economic growth was defined as an increase in total and per capita output of the country. A quantitative approach was adopted since material progress is essentially what we mean by economic development. The general model assumed that the level of output at any time was determined by the supply of resources (land, labor, and capital), the state of technology, the business and marketing organization, and the general social and cultural attitudes of the population. These were analyzed over the years 1913-1938 to see to what extent they were responsible for the rate of economic growth in France. Other industrial countries and known economic relationships were used as a basis for comparison.

One of the factors studied was the position and contribution of French agriculture. Statistics showed that developments in French agriculture were at a slower pace than her industrial neighbors. The small-scale and divided organization of farm lands, the sheltered position from world competition, as well as the cherished role of the peasant were cited as reasons.

With the lack of a significant increase in agricultural

output, it was not possible to transfer workers to industrial work where their productivity would have been greater. The small amount of the population that did leave agriculture pursuits took up work in neighboring villages as small shopkeepers. Rather than adding to the overall increase in real income, they only depressed it.

Natural resource endowment was considered as a limiting influence in French growth. While France has many of the resources needed for modern industry, certain essential ones are lacking and this void has played a part in her economic development.

France's position and influence in foreign trade was studied as a determinant in her pace of progress. The changing structure in commodities traded after World War I affected France in a negative manner, for the very products that were declining in world trade were also the very ones that had been the most important exports of France. Certain other countries came out of the war in a more favorable position both industrially and from the standpoint of specializing in the type of products most demanded in world trade.

As one other explanation for the relative stagnation in industrial output in France, the lack of capital formation was studied. Even in the years 1927-1930, the period of greatest net capital formation in France between the wars, net domestic investment averaged only seven per cent of net national product. Explanations were found partly in the penchant for foreign investment and the peculiar position that investment banks played in this.

Interwoven throughout the process of change, and directly affecting French progress, was the human factor. Expressed in the general cultural and social framework surrounding business, it was analyzed in terms of entrepreneurship. The dominant pattern, one characterized by excessive adherence to traditional ways and practices, put an emphasis on maintaining the status quo and of playing down competitive aspects. The business firm and family status were so intertwined that vigorous prosecution of new ideas and risk taking were largely abandoned in favor of pursuing policies directed toward maintaining a comfortable but secure existence. Such a conception could not but affect material progress in an adverse manner.

Thus it seemed that these factors - small-scale agricultural organization and retarded output, lethargical and traditionalistic business methods, scarcity of essential natural resources, changing world trade, and lack of capital formation - all contributed to the relative economic stagnation of France during the period 1913-1938. 199 pages. $2.60.

THE ECONOMIC ORGANIZATION OF A VILLAGE IN NORTH-CENTRAL INDIA

(L. C. Card No. Mic 58-2445)

William David Hopper, Ph.D.
Cornell University, 1957

Abstract not available. 400 pages. $5.10.

A METHOD OF MEASURING THE EFFECTS OF TARIFF PROTECTION: UNITED STATES DUTIES ON SELECTED IMPORTS, 1922-1950

(L. C. Card No. Mic 58-2429)

Donald Arthur Moore, Ph.D.
Michigan State University, 1956

Eighteen commodities, imported from eight countries, are used as examples in testing a statistical method of measuring the effects of changes in the levels of United States import duties.

For each commodity-country example, the following data are collected: (1) a wholesale price index of a commodity-group representing the foreign resource costs of the import, (2) a wholesale price index of a domestic commodity-group representing the resource costs of the domestic competitive commodity, (3) the rates of exchange, (4) the duty levied on the import in each year, (5) the ad valorem equivalents of the duties, and (6) imports of the commodity from the example country as percents of total imports and (7) as percents of domestic production. These data are in time series, for the years 1922-1950, or for shorter periods, for which data were available.

The foreign price index is converted to United States dollars. A ratio is then constructed of foreign/U.S. price indexes, current year ÷ foreign/U.S. price indexes, base year. This ratio is the change in relative foreign-U.S. costs since the base year. This is multiplied, for each year, by the rate of duty in the base year, to construct a series which is an index of changes in the impact of a given rate of duty. This is called the "protective equivalent of the base year duty." Then the ratio is multiplied by the duty levied in each year; providing an index of changes in all relative foreign-U.S. costs, including the tariff.

The latter index, called the "protective equivalent of the current duty," is correlated with variables (6) and (7). The rank correlation method is used; checked with product-moment correlation in a few cases. This indicates the sensitivity of imports to the changes in all the costs of the import. Examination of the tables in which the data are arrayed permits identification of the events which affected imports.

Then linear regression is used to attempt to relate changes in the variable (5) with changes in (6) and (7), with the effects of costs (the protective equivalent of the current duty) held constant. Then the effects of costs on variables (6) and (7) are tested, with variable (5) held constant. A linear time trend is removed from each series, to account for any growth factor not related to costs or to the tariff.

Apparel wool from Australia is sensitive to all cost changes; not significantly so to the tariff, but to other costs with a coefficient significant at the ten percent level. Cattle from Mexico correlate significantly at the one percent level with both the tariff and other costs. Tomatoes from Mexico do not correlate significantly with either variable. Both cattle and softwood lumber from Canada are significantly (1% level) related to the tariff, but not to other costs. Aluminum from Canada is significantly related (5% level) with both tariff and costs, but nickel from Canada is independent of both. Coal-tar colors from Switzerland seem independent of the tariff, but related to costs. Swiss watch works are related to the tariff (1% level), but not to costs. Coal-tar colors from Germany were depressed in price by tariff discrimination, but their

quantities were unaffected. Textile machinery from both Germany and the United Kingdom was sensitive to the tariff, but sensitive to costs only in the German case. United Kingdom cotton cloth could not be analyzed. Cattle hides and flaxseed (Argentina), and jute and castor beans (India) could not be analyzed by linear regression methods. Useful analysis of the effects of duties could be performed by inspection of the tables, however.

On the whole, the effort involved in this method may be worthwhile. It arrays the data and brings in some of the non-quantitative information about each commodity, so that the correlations may be interpreted for what they are worth. It avoids the two principle objections to the measures of elasticity of supply of and demand for imports; the grouping of commodities and the failure to account for shifts of the demand or supply schedules. The latter defect is partially corrected with linear time trends, and by decisions to omit certain periods in which shifts were obviously taking place. 408 pages. $5.20.

THE CONTRIBUTION OF CERTAIN AMERICAN BUSINESS FIRMS TO THE DEVELOPMENT OF MEXICO SINCE WORLD WAR II

(L. C. Card No. Mic 58-2411)

Raymond Francis Pelissier, Ph.D.
The American University, 1958

This study is an attempt to study and analyze the ways in which United States private enterprise is beneficial to an underdeveloped economy to which business firms from the United States have migrated.

The specific ways in which American private enterprise brings something of value to a single foreign country are discussed. Mexico, the country chosen for the study, has considerable participation by American private enterprise in manufacturing, processing and trade. These areas provide many examples of the transmission of "Know-How" through private channels in Mexico.

This study is not concerned with the activities of all American firms which entered Mexico since World War II, but only with those firms engaged in manufacturing, processing or retailing. The largest group excluded comprises the branch sales offices in Mexico of American manufacturing and transportation companies.

As background for the study, a statement of certain theories of economic development, a discussion of the principal factors influential in the development of Mexico and the United States, and a summary of the requirements of a nation undergoing industrialization were made. The study describes, illustrates and analyzes certain contributions of American private firms engaged in retailing and a variety of manufacturing enterprises in Mexico. It also relates each of these contributions to the background discussion of the needs of Mexico.

Mexico was chosen as the country to be studied because industrialization has been progressing rapidly, foreign capital has been welcome, and American firms have entered in large numbers since World War II.

In this study facts concerning American business firms in Mexico have been collected, organized and analyzed. The factual information which forms the body of this study was partly available in published form in books, periodicals and other publications. Much information was secured through personal interviews in Mexico and correspondence.

The contributions of American private enterprise to the development of Mexico, in addition to the provision of additional private capital, were found to be:

1. Intensification of competition in the sale of products made or distributed by American private enterprise.
2. Providing a high quality product and causing Mexican competitors to improve the quality of their products.
3. Developing domestic suppliers.
4. Providing managers and technicians.
5. Providing industrial research, including the design of new products especially for Mexico.
6. Increasing the emphasis on employee welfare programs.
7. Training Mexican workers for industrial employment.

American private enterprise has made substantial contributions to the development of Mexico. American companies, however, have made little effort to explain what they have done. Consequently, nationalistic arguments against these firms have more influence than they deserve.

American private enterprise has been one factor influencing the economic progress of Mexico in the years since World War II. The Government of Mexico adopted a wise policy, therefore, by providing incentives to foreign private enterprise. These incentives, such as tax concessions and import duties were attractive to American companies. Many of them came to Mexico and brought the special characteristics of American private enterprise to that country.

There are two implications to underdeveloped countries, such as the other Latin American countries, from this study. First, American private enterprise can offer much to meet the needs of countries in the process of industrialization. Secondly, inducements to foreign private enterprise may be helpful in attracting these companies.

315 pages. $4.05.

THE FUTURE OF NATURAL RUBBER IN THE WORLD MARKET

(L. C. Card No. Mic 58-1233)

Chiu Hock Quan, Ph.D.
University of Colorado, 1957

Supervisor: Professor Morris E. Garnsey

The problem of the natural rubber industry began during World War II when the United States developed the synthetic rubber industry which ended the monopoly position of natural rubber. Since the end of the war, the competition of synthetic rubber has cost natural rubber a large share of the market, and the rate of substitution of synthetic for natural rubber is accelerating.

What had been a pre-war problem of monopolistic price-output determination has become a post-war problem of

competition and substitution. Natural rubber must now develop and compete in a free market. In view of the fact that the present disturbing relative decline in the market share of natural rubber may in the future become a disastrous absolute decline of the industry, the natural rubber interests should join forces to prepare a more positive program of action to insure the prosperity and survival of the industry.

However, efforts to improve the market position of natural rubber are handicapped by economic and technological obstacles, and the time-lag in the adjusting processes of natural rubber gives increased urgency to the need for attacking these problems immediately if synthetic rubber is to be prevented from completely taking over the rubber market. To provide a concrete objective for a concerted and continuous program of rehabilitation, the natural rubber industry should attempt to maintain a pre-determined share of the market. A realistic goal would appear to be a share of no less than sixty percent of the total market for new rubber.

To achieve this objective, the natural rubber industry must go through a vigorous program of rehabilitation in the form of replanting programs, and new investment in rubber plantations as well as research into improved and new uses for natural rubber. New investment in natural rubber must be encouraged, and the rubber countries of Asia should be prepared to offer foreign capital terms competitive with the alternative investment opportunities offered by other locations. The post-war pattern of new investment in natural rubber indicates a possible shift in the regional structure of the natural rubber industry unless Asia undertakes a vigorous expansion program.

Replanting must be stimulated at almost any cost inasmuch as there is little prospect for substantial new investment in rubber plantations in Southeast Asia. The governments of the rubber producing countries should participate very actively in replanting programs through subsidies and loans. To increase the productivity of natural rubber plantations, the governments concerned must be prepared to prevent the decline of the surface yield of plantations and to permit market forces to eliminate inefficient producers. The technological problems of natural rubber must be solved primarily through research with the support of all segments of the industry. Finally, a search for new markets should be made for natural rubber in Asia itself as well as in certain underdeveloped regions. These markets should be exploited to offset the declining use of natural rubber by such highly industralized countries as the United States.

The policy suggestions here made are not however motivated solely by a concern for the economic wellbeing of the industry itself. The real significance of the natural rubber industry is derived from its importance to the economics of such countries as Indonesia and Malaya. Although the economic importance of natural rubber will decline in the future, for the next several decades the rubber industry will continue to be virtually the backbone of their economies. To these countries natural rubber is not merely a commodity but their one best hope for further economic development. It is therefore crucial that they insure the continued growth of their natural rubber industries.

214 pages. $2.80.

AN ANALYSIS OF JAPAN'S EXTERNAL DISEQUILIBRIUM TEN YEARS AFTER THE END OF WORLD WAR II

(L. C. Card No. Mic 58-2412)

Arthur O. Sharron, Ph.D.
The American University, 1958

Statement of the Problem

Japan stands out more than any other industrialized country as having a serious problem of international disequilibrium. This problem has been worsened as a result of the effects of World War II, such as the loss of her colonial sources of foodstuffs and the drastic curtailment in trading opportunities with her neighboring countries. Moreover, the case of Japan is not duplicated elsewhere in that despite having almost minimum wage and consumption levels, which reflect the extent of internal adjustments to the external disequilibrium, she is finding it increasingly difficult to export enough manufactures to other Asian countries in return for their rice surpluses because of insufficient demand for such manufactures and insufficient supply of exportable rice surpluses. It is largely for thes reasons that Japan is presently more dependent than prewar on trade with the United States, which can provide Japan with both the effective demand for Japanese exports of manufactures and the available supply of grains, includ ing rice.

The research problem, therefore, consists of an analysis of the following: (1) how Japan's external disequilibrium was aggravated during the postwar period and some of its unique characteristics, (2) the internal effects of the disequilibrium in terms of the inter-relationships of low industrial wages, low agricultural productivity and low levels of trade, and (3) the current magnitudes for Japan's food requirements, foreign food availabilities, and growing dependence on United States sources based on commercial trade, free of import quotas against Japanese exports.

Analysis and Results

The analysis consists of the use of precise statistical relationships, as far as possible free of general purpose statistics, theoretical formulations and textual quotations. The following are analyzed chapter by chapter: (1) the lag in Japan's trade recovery compared with other industrialized countries, (2) the structural loss of markets as a result of the war and contributing to the lack of trade recovery, (3) the reduced availabilities of world rice supplies, (4) the minimum level of Japanese food consumption, (5) the low levels of Japanese agricultural productivity because of excessive population on farms, and, (6) the low levels of industrial wages in modern industries because of low agricultural productivity.

Conclusions

The low level of per capita consumption in the face of a highly developed plant capacity suggests a lack of foreign markets for Japanese manufactures even at minimum costs. An expansion of Japanese exports is necessary to maintain the minimum feeding level as the population increases. The problem of reducing the disguised unemployment in Japan will be alleviated only as food consumption is increased and the proportion of income spent on food is reduced. An increasing share of Japan's trade may have to be with the United States if Japan is to maintain its

present level of food consumption with a reasonable proportion of rice. But, there are other solutions too, one of which is the expansion of Japanese trade with Southeast Asia, such as might well result from a development program in this area, especially with a capital outflow from the United States. These, however, are political as well as economic problems and, consequently, are not within the scope of this dissertation. 253 pages. $3.30.

ECONOMICS, COMMERCE—BUSINESS

SOME ASPECTS OF THE PROBLEM OF UNPLANNED PLANT MAINTENANCE

(L. C. Card No. Mic 58-2030)

Albert George Holzman, Ph.D.
University of Pittsburgh, 1958

In the first part of this dissertation a framework was developed to enable one to solve analytically some of the unplanned maintenance queries. A structure was developed for the following criteria: random order of arrival; exponential and constant service times; and service of demand by order of arrival or by random selection.

Exploratory considerations were made on an objective approach to the determination of manpower requirements for the random occurring activity. An investigation was made of the costs involved with differentiation made between (1) service personnel idle when all activities are operative, and (2) some service personnel idle time used productively on other assignments. Specific examples were analyzed to indicate that the proposed solution structure for the unplanned maintenance activity can be applied also to assignment of material handlers and to allocation of funds for receiving docks in a typical warehouse.

A substantial contribution of this dissertation is an analysis of unplanned maintenance in the machine shop of a large industrial plant. This study was the first attempt made to apply research methodology to the maintenance problem in this plant.

In the analyses of the actual unplanned maintenance function, statistical tests indicated that the order of arrival for the repairs was random. A frequency distribution of service time was tabulated and compared with the theoretical exponential frequency distribution. An analysis of unplanned maintenance crew assignments was conducted with the conclusions highly significant.

The present practice in this shop is to assign one repairman to a specific floor on the day shift. However, it was found in this research that assignment of the two repairmen to two floors, instead of one repairman to each floor, would reduce the average delay time significantly. The average delay on calls delayed also was scaled down. The savings result merely from a change in work force assignments.

Cost analyses were made to compare present assignments with the proposed assignments. Two different groups of data were investigated and waiting time cost expressions developed. For Data Group 1 the proposed assignment total waiting time cost was approximately one-half the cost for the present method, and for Data Group 2 the proposed assignment cost was less than half of the present method. A chart was constructed to show when it is economical to add or reduce maintenance personnel for a predetermined range of the parameters.

Analyses of variances were made to test for significant differences between the mean time of selected classes of unplanned repairs and the mean time of unplanned repairs by year.

Contingency tables were developed to test for independence between certain factors, i.e., to determine if a specific classification of data is independent of another classification of the same data.

Correlation and regression analyses were utilized in the critique of functional relationships of certain variables in the unplanned maintenance problem.

In summarizing, it is stated that the results of this investigation clearly exhibit the possibility of reducing service queueing time and concomitant costs, thus providing the stimulus for management to pursue further research methods in attacking the random service demand problem. 203 pages. $2.65.

BUSINESS CONDITIONS, PUBLIC POLICY, AND ECONOMIC BEHAVIOR: AN INTERPRETATION OF THE 1953-54 RECESSION

(Publication No. 15,765)

Edward George Koch, Ph.D.
University of Michigan, 1955

The major purpose of this study is to explore the question: Why did the 1953-54 recession, which might have been severe, turn out to be moderate? The significance of this question arises from the fact that (a) in the winter of 1953-54 many people feared that a depression would again bring hardship and suffering to the nation; (b) some people clamored for drastic action by government to dam the ebbing tide in business activity, while a few advocated more than a holding action; and (c) although grave concern about economic developments was a real factor in early 1954, business conditions constantly improved; by the time the year was out, the 1953-54 recession was a matter of history instead of an immediate concern.

The subject of the study covers the examination of aggregate business activity and a further analysis of the aggregate data in order to suggest possible reasons for the variations that occurred. From the very nature of the case, this method of examination requires that the rule of preponderance of evidence be accepted.

Certain limitations, however, are inherent in the study. In the field of public economic policies as they affected aggregate business activity, this study concentrates on fiscal and monetary affairs. Moreover, the use of national income accounting data, business indicators, and survey information is always subject to qualification as to their reliability in depicting actual events. This qualification is especially true of consumer and business psychological surveys on which certain sections of the study depend.

With the subject and limitations as given, the chief topics of study are presented in the following order:

(1) consider the mildness and the principal characteristics of the 1953-54 recession; (2) establish that it might have been severe; (3) show the role of both fiscal and monetary policy in keeping the 1953-54 recession from being something worse; and (4) demonstrate the importance of the economic behavior and responses of consumers and businessmen in preventing a more severe decline.

This study of the 1953-54 experience suggests that, partly by good fortune but largely by design, the timing and appropriateness of public policies held in check what might have become a cumulative downward economic spiral. In doing so, fiscal and monetary policies engendered the economic responses of businessmen and consumers to cushion the impact of the recession, and ultimately to bring about full business recovery. Two reasons are offered for these results. First, the economic behavior of businessmen and consumers, which accounted for the relative stability and the later improvement of business conditions, were manifestations of their favorable psychological reactions--their motives, attitudes, expectations, and intentions. Second, their psychological responses, which were reflected in the continual strengthening of confidence about the short- and long-term future, were manifestations of the economic consequences of government policies.

The study leads to the general conclusion that, although the business cycle is not yet conquered, it is reasonable to expect that the economic behavior of businessmen and consumers can have a stabilizing effect on business conditions if public policy can avoid large swings in economic activity. 274 pages. $3.55. Mic 58-5042

AN ANALYSIS OF THE MARKETING OF UTILITY AIRPLANES, WITH EMPHASIS ON MARKETING PRACTICES AND PROBLEMS OF MANUFACTURERS

(L. C. Card No. Mic 58-2117)

John Samuel Wagle, Jr., Ph.D.
The Ohio State University, 1957

This is a study of the marketing of utility airplanes by manufacturers. The word "utility" refers to those airplanes produced for use in general aviation. "General aviation" is a term which encompasses all civilian aviation except scheduled and non-scheduled airline activity.

The objectives of the study are (1) to analyze marketing problems faced by the manufacturers, (2) to examine the reasons for the adoption of distribution practices, and (3) to evaluate these practices in the light of good business procedure.

The problems to be examined were compiled as a result of more than thirty informal interviews with executives in airplane manufacturing and distributing companies as well as in related concerns. Four categories of problems were found in connection with (1) delineation of the characteristics of the market for utility airplanes, (2) organization of the manufacturers' marketing division, (3) channels of distribution and margins, and (4) additional phases of distribution. Analysis was made by means of a second set of exhaustive interviews with key executives in the industry and by a study of unpublished internal records of manufacturing concerns.

There are three aspects of the utility airplane industry which cause many of the problems and practices studied in this research. The first is abrupt fluctuation in the market for civilian aircraft. In an attempt to lessen the risk caused by these changes in demand, producers have adopted the practice of requiring a deposit at the time the order is placed and full cash payment when the airplane is delivered. These procedures have eliminated some prospective purchasers from the market because they lack the necessary capital to make cash payments. To solve this problem, the producers have sponsored a number of financing and leasing arrangements through banks and other institutions.

The second aspect of significance is the change in use of civilian aircraft. The trend is to business and commercial use. Few airplanes are purchased primarily for pleasure. As a result, utility airplanes are now sold in an industrial goods market. Most of the distribution functions, however, are conducted as though a consumer goods market still prevailed. If maximum sales are to be attained, selling appeals and marketing techniques, as well as aircraft design, must be studied and developed in the light of this changed market.

The third aspect is the philosophy which pervades the industry that production is far more important to company success than is marketing. Three weaknesses result from this concept. First, there is a lack of organization balance between divisions of the producing companies. Production is emphasized; marketing is relegated to a minor role. Second, there is a lack of balance between functions in the marketing divisions of the producers. Finally, there is a lack of provision for organization stability and growth.

The study concludes that the utility airplane industry is an oligopoly with differentiated products. There is very little tendency to cut price. Competition in the future is expected to be in the form of advertising, sales promotion, marketing research, sales techniques, and product design. Most of the producers are not yet prepared to emphasize marketing functions, so that the producer who moves first and most forcefully in these distribution activities will gain a lead in the competitive battle. Those who lag behind in developing the marketing phase of their business are likely to experience adverse effects, resulting in a smaller share of the total market. 241 pages. $3.15.

ECONOMICS, FINANCE

STATE AND LOCAL TAX BURDENS IN NORTH CAROLINA AND THE SOUTHEASTERN STATES

(L. C. Card No. Mic 58-2458)

Leslie Ellerton Carbert, Ph.D.
Columbia University, 1958

In terms of some of the common indicia of economic welfare, it is clear that North Carolina's position is one of severe economic distress when the State is compared with other states in the United States and, indeed, with other states in the Southeast. In general, there is a need for sweeping agricultural reform, including a consolidation of farm units, a change in the structure of land ownership,

and the mechanization of agricultural processes. In order that the labor force which would be released by such agricultural reform may be more effectively utilized, there is a need for complementary industrialization. The specific need is for industries that tend to be high-wage industries wherever they are located and for industries that are not based solely upon indigenous natural resources.

A number of industries of a type considered to be especially desirable from the point of view of North Carolina's industrial needs are selected. From data for existing firms, hypothetical firms are constructed and hypothetical plants are located on specific sites in each of the eleven Southeastern states. Tax burdens are computed for each of these plants to illustrate the impact of all state and local taxes, except sales and use taxes and unemployment insurance taxes, in each of the Southeastern states. Such calculations are based on the assumption that the tax burdens implied by the law are real burdens.

Both the methods and the results of this comparison are displayed in detail. It is shown that the tax burdens imposed by North Carolina on the hypothetical plants are substantially higher than those imposed by most other Southeastern states. In most cases this result arises because of the relatively high corporate income tax rate, the unusually severe formula used to allocate multi-state income, the absence of a deduction for federal income taxes, the relative absence of property tax exemptions, and the fact that relatively low property tax rates tend to be offset by relatively high assessment ratios.

Through an examination of several manufacturing enterprises now located in North Carolina and other Southeastern states an attempt is made to discover whether the comparison of hypothetical tax burdens is valid for actual corporations. For the most part, the hypothetical analysis is supported, although the character of the examples somewhat limits the usefulness of the results for these purposes.

An interstate comparison of actual tax burdens is made for a retail chain store. Here, too, the results tend to show relatively heavy tax impositions by North Carolina as compared with those by other Southeastern states.

It is pointed out that the study represents an analysis of only part of the total tax burden comparison, and that extensive revision of the tax structure of North Carolina should await an extension of the study. The findings of the present study would seem, however, to justify a revision of the State's income allocation formula. Recourse to a full-scale program of industrial attraction by means of large tax favors in competition with other Southeastern states is discouraged because of the probability that such methods would not serve to attract the most desirable types of enterprises; because of the necessarily regional character of economic development in the Southeast; because of the dangers of cutting much-needed expenditures; and because of the possibility of shifting tax burdens to the shoulders of taxpayers less able to bear them. It is also suggested that there is a need in the North Carolina tax structure for abandoning the granting of substantial relief by administrative adjustment and for writing the tax laws in such a way that they may be uniformly administered and democratically controlled. 388 pages. $4.95.

ECONOMICS, HISTORY

UNITED STATES ECONOMIC POLICY TOWARD GERMANY, 1945-1949

(L. C. Card No. Mic 58-2240)

Jerome Martin Pines, Ph.D.
Columbia University, 1958

The thesis discusses the economic policy of the United States toward Germany during the four years following the end of World War II. It covers the pre-surrender planning such as the Atlantic Charter, conferences of the foreign ministers, Teheran, the Quebec meetings, the European Advisory Commission, the Morgenthau Plan, the Yalta Conference, JCS/1067 and U.S. preparation for Military Government.

Shortly after the surrender, the control machinery, prepared by the European Advisory Commission and approved at Yalta, became effective. This machinery provided for absolute control over Germany and all its subdivisions by the victorious Allied Powers, the division of control into zones, the establishment of the Control Council and the administration of Berlin.

Following the surrender, the Potsdam Conference was convened to discuss the problems facing the Allies in post-war Germany. The most important of these problems were the movement of large numbers of displaced Germans and other displaced persons, the breakdown of the German economy, reparations, agreement on Germany's new borders and the governing of Germany by the Allies as an economic unit.

Following Potsdam, the United States occupation authorities were not only concerned with the basic problems of governing a country whose economy had been shattered but also with the refusal of the Soviet Union to follow the Potsdam mandate of treating Germany as an economic unit. The Soviet Eastern Zone and the Soviet sector of Berlin were isolated from the remainder of Germany. The U.S.S.R. also, was absorbing in its Zone reparations that had not been authorized and was establishing Germany's eastern border without the required approval of a Peace Conference. These activities were the fore-runners of greater occupation difficulties to be experienced between the Western Allies and the Soviet Union.

Prior to the surrender, a Commission of Reparation had been established by the United States, United Kingdom and U.S.S.R. This was succeeded, in January, 1946, by the Inter-Allied Reparation Agency, whose function was to apportion the reparations made available by the Allied Control Council.

In accordance with the provisions of JCS/1067 and Potsdam, U.S. economists attempted to establish a level of industry which would provide for industrial disarmament, reparations and the assurance that the German people would not have a higher standard of living than the peoples of the other European countries. As time passed, the United States kept changing this policy with the realization that a low level of industry for Germany would retard general European recovery and would require large imports from the United States for a starved, German people.

The United States became increasingly concerned with the Soviet refusal to treat Germany as an economic unit. Late in 1946, the U.S. and U.K. agreed to merge their zones and invited the U.S.S.R. and France into this union.

France did not join until another two years had passed. By that time, the U.S. had inaugurated the European Recovery Program, which aimed to bolster the economies of the European countries who were attempting to resist the agressiveness of international communism. Western Germany was included in this program.

The United States now moved towards the establishment of a West German government to include the three Western Zones. Such a government was established in 1949. This made much less probable the re-unification of Germany since, as a retaliatory measure, the U.S.S.R. established its Eastern Zone as a new state. The re-unification of Germany remains as one of its chief internal problems and a thorn in the relations between the democratic countries and the U.S.S.R. 373 pages. $4.80.

THE AGRARIAN REFORMS OF JOSEPH II IN BOHEMIA, 1780-1790

(L. C. Card No. Mic 58-1250)

William Edward Wright, Ph.D.
University of Colorado, 1957

Supervisor: Professor S. Harrison Thomson

Central European serfdom is general and, specifically, Joseph's reform program designed to abolish it in Bohemia, have not been treated by English-speaking scholars. Moreover, a significant phase of the abolition program--that of commuting robota (forced, unremunerated labor) to money fees and distributing the land of the state controlled estates to the serfs--has not been treated independently, or in depth, even in western European languages. The purpose of this dissertation is to present such a study in English, with a special emphasis on the abolition of robota on state controlled lands.

In the preparation of this work the author has studied the numerous documents in the Vienna Hofkammerarchiv under the rubric Robotabolitions-Sachen, and published sources, primary and secondary, chiefly in German and Czech.

After the defeat of Bohemia at Bílá Hora (1620) the serfs' subjection to the lords was made more onerous, and later in the seventeenth, and early in the eighteenth century, with the growth of the power of the nobility vis-à-vis the monarch, the oppression of the serf was nearly complete. Not until Maria Theresa began to reassert monarchial control over the nobility did the fortunes of the serf improve. In centralizing political administration in Vienna, the Empress began to break the power of the nobility; in attempting to increase the tax income she found it necessary to protect the serfs from the rapacity of the lords. However, her agrarian legislation only curtailed some of the evils of serfdom; it did not cut to the core of the system. On the estates under royal jurisdiction, where she had a free hand, she began to abolish robota and to distribute land to the peasants.

When Joseph II acceded to undivided authority in 1780, he was less hesitant than his mother had been. He was a student of the Enlightenment and the Physiocrats, and worked energetically to put those principles into effect in his lands. At the end of the first year of his reign, Joseph abolished Leibeigenschaft and strengthened the serfs' rights to hold and use land. The serf was given the freedom to arrange his private affairs as he saw fit and was released from his bondage to the land. Joseph charged a court commission, under the presidency of Karl Graf Zinzendorf, to continue and accelerate the program of land distribution and robota abolition on state lands. Peasants were to be released from physical robota on the payment of fees and they were to acquire hereditary leases to the land for rentals paid in money or kind.

The first abolition agent for Bohemia, Hofrat von Hoyer, acted in contravention to the principles formulated by limiting leases to serfs to periods of six years and by making robota abolition contingent on the land leases. Joseph discharged Hoyer and placed Johann Erben in charge of the program in 1785. Erben overcame the dissatisfaction engendered by Hoyer's conduct and carried out the principles of abolition as originally stated. It was found that not only did the serf profit from the system, but also that the income from the estates was maintained under the system. The result of the program was that large estates became communities of free peasant small-holders with nearly complete ownership of their land.

In 1789 Joseph issued a land tax and agrarian patent extending the abolition robota to all serfs in Bohemia who paid two or more florins land tax annually. He reduced their total payments to the state and the lord to thirty per cent of their gross incomes, thus more than doubling the portion of their incomes that the serfs could retain for themselves. Although this patent applied to only about one-fifth of the serfs on private estates, the Bohemian nobility strongly opposed it, contending that it was based on an inaccurate land survey, and because it taxed them at the same rate as the serfs. Joseph died a few months after the publication of the patent and was not able to meet the opposition to it and enforce its acceptance in Bohemia. His successor, Leopold II, rescinded the patent in 1790.

In a brief decade, in the face of stubborn resistance, Joseph II had freed the Bohemian serfs from bondage to the land, freed many from robota, and made them nearly fee-simple owners of their land. This was accomplished in a conservative society without the support of a revolutionary class such as the bourgeoisie in France in 1789.
339 pages. $4.35.

ECONOMICS, THEORY

PROCESSES OF INTERNAL CONTROL IN FIRMS

(L. C. Card No. Mic 58-2150)

Chadwick John Haberstroh, Ph.D.
University of Minnesota, 1958

Purposive regulation of a system can be achieved with a high degree of certainty only if information on deviations of performance from the criterion are fed back into the system in such a way as to reduce the magnitude of the deviation. In large-scale business enterprise, control functions depend primarily on the organizational structure under which the firm operates, rather than on the actions

of an individual entrepreneur. The essential elements of structure are the channels carrying information on performance; the purposes of organization, from which the control criteria are derived; the executive system that determines how the organization's resources are used; and the technical program available for goal achievement.

The purposes of organization and the programs for achieving them are defined in terms of the situations to be achieved and the means activities used. They are derived operationally by a content analysis of the organization's internal communication. Because of the operation of internal and environmental forces, an organization will tend to hold a small number of mutually independent, operative goals. The conditions for a goal being operative are that means activities be known for achieving it and that information be available as to the extent of its achievement.

Control of an organization is achieved if its executives respond to information on goals and performance in such a way that goal achievement is facilitated. In the normal routine this would be achieved by executive sanctions reallocating resources into means activities relating to threatened goals. However, the organization's technical programs may often by somewhat less than fully reliable, in the sense that means activities may not lead to goal achievement with certainty and to known degree. Where this is the case, the organization may respond to failure by innovation in the program of means activities and/or changes in the organizational structure. There are limitations on the size of a system that can be stabilized practicably in this way. Thus, purposes relevant to the functioning of a large and complex organization will be factored into simpler goals that are jointly sufficient and independently controlled.

The organizational structure of a large industrial plant was studied by observation and interview and was analyzed in terms of the above model. Four organization purposes were discovered, relating to production, costs, safety and medical care. In at least the first three of these areas, the goals were operative. Time-series data were available on performance, and goals were explicitly formulated in the same terms as the time-series data reported.

In an intensive study of the safety program, it was found that executives adjusted program activity levels depending on the accident rate. The time-series data on accident experience were consistent with what could be predicted from this, together with existing theory of accident processes.

The prevention of industrial accidents is obviously an area where technical programs are not fully reliable. A positive relation was found between the discrepancy between safety goals and actual performance on the one hand and the rate of innovation in the safety program by top management, as measured by an observer's ratings of the plant's historical reports. The plant safety goals were regularly broken down into corresponding divisional and departmental goals. Innovation at the division level was also related to the discrepancy between goal and actual performance. 143 pages. $2.00.

A WESTERN INFLUENCE ON JAPANESE ECONOMIC THOUGHT: THE MARXIAN NON-MARXIAN CONTROVERSIES IN THE 1920'S AND THEIR SIGNIFICANCE FOR TODAY

(L. C. Card No. Mic 58-2245)

Kyohei Sasaki, Ph.D.
Columbia University, 1958

Economic theories followed a different pattern of development in Japan from those followed in advanced countries, especially England. In the early part of the Meiji Period (1869-1920) the works of economists of the Classical School such as Adam Smith and David Ricardo were introduced but apparently gained little popularity. From 1900 to 1920, during the industrial revolution in Japan and World War I, the German New Historical School, or Social Policy School, played a predominant role in Japanese economic thought. After 1920, however, this school lost ground to Marxian economics due to the sudden rise of Marxism in Japan. Since then, Marxian economics has played a dominant role in both academic and non-academic circles. Pari passu with the rise of Marxian economics, there spread a re-evaluation and reexamination of the Classical School. After 1910, Neo-Classical economics was introduced and Schumpeter's The Theory of Economic Development was translated in 1936, but they did not become as popular as Marxian economics. In the 1930's and after World War II, Keynesian income and employment theory and Harrodian dynamics theory as well as other similar theories were introduced and gained popularity. It seems clear, however, that at present in Japan Marxian economics still maintains a formidable position both in academic and non-academic circles.

This study is an examination and evaluation of a series of related theoretical controversies between Marxian and non-Marxian schools of economic thought during the 1920's. The controversies developed immediately after the sudden rise of Marxian economics and they involved, on the one hand, the members or the former members of the Social Policy Society and, on the other, the Marxian economists. The principal proposition at issue in the controversies was the labor theory of value and its relation to price.

The study has two objectives: (1) examination of the controversies; (2) examination of the characteristics of Japanese economic thought in the past as well as its future prospects. In dealing with the first objective, investigation is also made of the social and economic conditions that led to the controversies, and a comparison is made of Joan Robinson's model (The Rate of Interest and Other Essays) and Marx's Reproduction Schema. The latter comparison throws light on the present significance of the controversies.

In connection with the second objective, the controversies reveal the following characteristics of Japanese economic thought in the past: (a) non-Marxian economists study Marxian economics, but until recent years, they were interested in its study only for the sake of refuting it; (b) because of the characteristics stated, there was no real communication between the two groups; (c) as Professor Martin Bronfenbrenner puts its, Japanese Universities enjoyed great freedom at a time when the relative suppression of Marxian economics was taking place in America. These characteristics persisted into the post World War II period, but they have become less pronounced in recent years, partly because dynamic economic growth

theories have begun to command popularity among the non-Marxian economists, and hence, the two varieties of economics have come to have a certain common ground. This situation offers an opportunity for the two groups of economists to learn from each other by the stimulating exchange of ideas, and probably will help to create original economic thinking that ought to aid in solving economic problems peculiar to Japan. 166 pages. $2.20.

EDUCATION

EDUCATION, GENERAL

A GENERAL STUDIES CURRICULUM IN SCIENCE AND MATHEMATICS FOR COLLEGES OF EDUCATION IN OREGON*

(Publication No. 22,581)

Ralph Emerson Badgley, Ed.D.
University of Colorado, 1956

Supervisor: Associate Professor Harold M. Anderson

The purpose of this study was to prepare a suggested general studies curriculum in science and mathematics for the Colleges of Education in Oregon. Particular attention was given to the problems which arose in the committee charged with the responsibility of setting up the initial program which began in the Fall of 1954.

Data were obtained from questionnaires sent to selected colleges and universities in the United States, from an analysis of catalogs of representative institutions and from a survey of literature. Eighty per cent of the authorities in the 140 institutions selected on the basis of whether or not they offered some type of broad-field curriculum, responded.

Three of the functions of general education chosen by the largest number of respondents were: an acquaintance with and a facility in the basic disciplines such as logical reasoning, inference, generalization, and reflective thinking; the integration and unity of all educational experiences; and the transmission of culture. Very few believed that general education should be universal education. Reaction against over-specialization was apparent but it was also apparent that the great majority of the institutions reporting were very conservative about departing from traditional subject-matter majors and basic introductory courses for specialists in a narrow field.

Where departures from narrow specialization were made (other than the two year general education core adopted by many institutions) breadth of concentration was obtained by means of distributed majors, cross-divisional majors, divisional majors, interdepartmental majors, combined majors, and area majors. A few completely individualized majors for the more gifted student were reported.

Integration was considered by most respondents to be inter-relations within a given subject-matter and of a given subject-matter with other subject-matters. This was accomplished by means of a prescribed core; a required distribution of courses in each of the general areas of the Humanities, the Social Sciences, and the Natural Sciences and Mathematics; and by special courses and methods. A large number of respondents expressed an opinion in favor of a course in philosophy which would help provide a unifying element in the students educational experiences.

The typical distribution between the general areas was sixteen semester hours in the area of the Humanities, twelve semester hours in the area of the Social Sciences and twelve semester hours in the area of the Natural Sciences and Mathematics.

The broad type curricula with a major concentration in Science-Mathematics provided for depth as well as breadth. This was accomplished by requiring a minimum number of credit hours in a particular subject-matter. The greatest weaknesses were in the small number of upper-division course requirements and in the small number of prescribed courses in mathematics. None of the institutions reported a four-year curriculum composed largely of integrated courses and the respondents expressed considerable opposition to such a program. Some integrated courses were used but these were limited to a small basic core and were restricted to the general studies programs only. The majority of the institutions reporting used the regular liberal arts courses, "almost entirely," for the broad type programs.

It is recommended that the Colleges of Education in Oregon give further consideration to the aims and objectives of the general studies program in the light of the findings of the survey and related studies, and that experimental integrated courses be developed in all areas where they do not presently exist. 168 pages. $2.20. Mic 58-5043

*Copies of this dissertation cannot be sold.

THE EDUCATIONAL PHILOSOPHY OF TEACHERS OF HOME AND FAMILY COURSES IN THE PUBLIC GENERAL SECONDARY SCHOOLS OF LUZON, PHILIPPINES

(L. C. Card No. Mic 58-2443)

Eva Beatriz Gonzalez, Ph.D.
Cornell University, 1958

This study was an attempt to identify the characteristics of the educational philosophy of 253 home economics teachers who are currently teaching Home and Family courses in the public general secondary schools of Luzon, Philippines.

Information was obtained from these teachers by means of a Situation Schedule. Teachers were asked to react to twelve hypothetical school situations by choosing one of five responses to each situation which most nearly approximated their own reaction. The responses were set on five levels which were characterizations of authoritarian, partly

authoritarian--partly democratic, democratic, partly democratic--partly laissez-faire, and laissez-faire methods of teaching. Educational philosophies of the teachers involved in this study were identified through their choices.

The data were treated in relation to ten variables which might have had some bearing on the manner in which the teachers responded to the Situation Schedule. The following hypotheses which were concerned with the variables were tested:

1. There is no difference between the philosophy of the Philippine educational system and that of teachers of Home and Family courses in the public general secondary schools of Luzon, Philippines.
2. There is no difference between the attitudes and beliefs of teachers who have taught for over twenty years and those of teachers who have only been teaching within the past ten years.
3. There is no difference between the philosophy of teachers in urban sections and that of teachers in the provinces.
4. There is no difference between the attitudes and beliefs of teachers whose parents have been or are teachers and those whose parents have not been teachers.
5. There is no difference between the attitudes and beliefs of teachers who had enrolled in private schools and those of teachers who had enrolled in public schools.
6. There is no difference between the attitudes and beliefs of teachers who are married and those who are not.
7. There is no difference between the attitudes and beliefs of teachers of Home and Family courses who have children the same age as the group they teach and those of teachers who do not have children.
8. There is no difference between the type of personality the teacher possesses and the teaching method she employs.

In their responses, the teachers expressed a democratic philosophy, indicating that they are aware of these principles. The study did not prove that these teachers reflected democratic principles in their teaching behavior. No statistically significant differences were found in the philosophies of these teachers, when they were classified according to the length of time spent in teaching, type of home and school community lived in longest, teaching experience of parents, type of school attended (public or private), in-service training, civil status, and number of children. Through the use of the abbreviated F (authoritarian) scale, which estimated anti-democratic tendencies at the personality level, a possible explanation for the teachers' reaction to the hypothetical situations was sought. Teachers' responses to this scale showed them to be anti-democratic in personality. The statistically non-significant correlation between teachers' scores on this scale and on the Situation Schedule showed that there is no relationship between one aspect of the teacher's personality and the teaching method she said she would employ in certain situations. The polarity of results obtained from the two tests was explained from a cultural standpoint.

This study has served to explore the relationships of certain factors within the experience of teachers with their attitudes and beliefs about teaching. One value of the study can probably be said to lie in its support of the effectiveness of the Bureau of Education in promoting the democratic principles of teaching. 141 pages. $2.00.

AN ANALYSIS AND COMPARISON OF THE ADJUSTMENT PROBLEMS OF NONACHIEVING COLLEGE STUDENTS OF LOW SCHOLASTIC ABILITY AND OTHER GROUPS OF ACHIEVING AND NONACHIEVING STUDENTS

(L. C. Card No. Mic 58-1216)

Vern Harmon Jensen, Ed.D.
University of Colorado, 1957

Supervisor: Associate Professor Clarence W. Failor

The major purposes of the study were: (1) to determine whether or not nonachieving students of low scholastic ability are also handicapped in nonintellectual areas of college life, and (2) to determine to what degree the adjustment problems of nonachieving students of low scholastic ability as a group differ from those of other achieving and nonachieving students. The purpose for making this study, therefore, was an attempt to gain a better understanding of the problems confronting nonachieving students of low scholastic ability in order to assist in formulating policy which may be to the advantage of both the students and the institution.

In conducting this study, 458 freshman students who entered the Brigham Young University in the autumn quarter of 1955-56 were selected from the entering freshman class. On the basis of certain selective criteria the 458 students were chosen and separated into four groups as follows:

1. Scholastically nonachieving students of low scholastic ability.
2. Scholastically achieving students of low scholastic ability.
3. Scholastically achieving students of high scholastic ability.
4. Scholastically nonachieving students of high scholastic ability.

Group comparisons were made on the basis of scores derived from the Minnesota Multiphasic Personality Inventory, the Kuder Preference Record, the Mooney Problem Check List, and the College Inventory of Academic Adjustment. The groups were also compared with respect to their participation in certain extracurricular activities based on information secured from a questionnaire. In order to focus the study upon the individual student, case studies were conducted in connection with ten of the nonachieving students of low scholastic ability.

With certain exceptions, there was a general tendency throughout this study for nonachieving students of low scholastic ability to indicate more adjustment problems than the other groups with whom they were compared. The gifted achievers, on the other hand, showed an inclination to express fewer problems than the other three groups.

A statement with respect to each of the criteria is presented as follows:

1. The nonachieving students of low scholastic ability showed a tendency to score higher than the gifted achievers on the majority of the MMPI scales.

2. On the Kuder Preference Record, those students who were less scholastically inclined most generally preferred areas of interest which were furthest removed from the traditional academic curricula of the University.

3. The nonachievers of low scholastic ability were inclined to express more problems than the other groups on the majority of the categories of the College Inventory of Academic Adjustment and also certain areas of the Mooney Problem Check List.

4. The two nonachieving groups expressed themselves as having less of a tendency than the other two groups to attend those extracurricular functions which were of a cultural or intellectual nature.

The above conclusions indicated that nonachieving students of low scholastic ability were not only handicappped academically, but were also at a disadvantage with respect to nonintellectual areas of college life. The study, therefore, offered additional evidence that these students have unique problems which will require serious attention by University officials. Two general recommendations were presented for consideration, namely: (1) improved admissions policies, and (2) improved programs and services.

For the improvement of present admissions policies it was proposed:

1. That scholastic aptitude test scores in combination with high school grades be used as a measure in establishing minimum admissions requirements.

2. That applicants having a high school grade-point average below a B be required to take a battery of tests before admission is granted.

3. That a research project be conducted to determine what the minimum requirement should be.

For the improvement of programs and services it was proposed:

1. That the status of students of low scholastic ability be checked early in the year in order that proper counseling may be offered.

2. That a committee be appointed to study terminal programs.

3. That an organized tutoring service be established.

4. That an in-service program for training faculty advisors be provided.

5. That a remedial course in general mathematics be offered.

6. That all staff members responsible for student affairs be informed of the special problems of nonachievers of low scholastic ability. 303 pages. $3.90.

A STUDY OF SOME FACTORS THAT CAUSE FEAR AND DISLIKE OF MATHEMATICS

(L. C. Card No. Mic 58-2362)

Leon Anson McDermott, Ed.D.
Michigan State University, 1956

This study was designed to determine what effect the following have had to make students fear or dislike mathematics: (1) first difficulties and attempted remedies; (2) the degree of ability in performing mathematical operations; (3) the degree of understanding the function of mathematics; (4) the preconceived idea that success in mathematics cannot be attained; (5) any break in sequence in the study of mathematics; (6) dependency on others to solve mathematical problems; (7) the emotional relationship to studies in general and mathematics in particular; (8) conflicts with others; (9) non-mathematical reasoning ability; and (10) recreational patterns.

The case study method was used to gather the data. A group of students at Central Michigan College was selected as subjects. These people who had developed fears and dislike of mathematics were referred to the investigator by remedial mathematics instructors and personnel counselors. In addition, some students who were proficient in mathematics were also interviewed. All students studied entered into the project on a voluntary basis. In all, 41 cases were studied, 34 of whom had developed a fear of mathematics and seven of whom were proficient in the subject.

Students participating in the study had educational backgrounds ranging from one-room rural schools to large city school systems.

All interviews were tape recorded. Further information pertaining to the student was obtained from tests and other records from the student personnel office of the college.

Each case study was analyzed individually; all cases taken together were then studied as a group.

The data indicated: (1) Most students having fear and dislike of mathematics met with frustration in the elementary grades; the remainder met with difficulty when they attempted the use of symbols in algebra and higher mathematics. (2) Students met difficulties by resorting to rote, by giving up entirely, by becoming hostile to the subject, by using inefficient methods, and by resorting to dishonest means to pass courses. (3) The students who developed fear think of mathematics as consisting of the four fundamental skills useful for commercial transactions; those proficient were only vaguely aware of its larger place in our society. (4) Most students who have developed a dread of mathematics have convinced themselves that they cannot succeed in this area. (5) There is some evidence that fear has been developed because students have missed some part of the subject by loss of school time or by failing to grasp some area of mathematics. (6) Students who have a fear of mathematics have a tendency to rely on others for help. (7) Those who have developed a fear of mathematics appear to prefer English, the social studies, and the arts, both fine and practical; they dislike the definiteness of mathematics. Those proficient in this subject frequently seem to be dissatisfied with what they take to be vagueness in the humanities, and are critical of those majoring in this area. (8) Both those who have developed fear of mathematics and those proficient in it have been influenced by others--parents, siblings, and peers. (9) There seems to be no conclusive evidence that lack of ability in reasoning is the sole cause of fear of mathematics. (10) There seems to be little difference in the recreational pattern of those who have developed fear of mathematics and those proficient in it. 265 pages. $3.45.

THE CYCLIC PATTERN OF HEIGHT GROWTH FROM BIRTH TO MATURITY

(L. C. Card No. Mic 58-2364)

Reuben Robert Rusch, Ph.D.
Michigan State University, 1956

The purpose of this study was to determine the individual cyclic pattern of height growth from birth to maturity. Although much research has been done with cross-sectional height data, there is relatively little evidence showing the individual pattern of height growth over even short periods of the growth process, and even less evidence to show the individual pattern from birth to maturity.

Fels Research Institute, Yellow Springs, Ohio, provided the longitudinal height measures which were used. Of the cases they had available the serial measurements of 46 girls and 31 boys met the criteria of completeness chosen for this study.

The straight line that best fitted the data was individually determined from the serial height measures taken at six month intervals. The measured heights were then compared to this straight line. The individual data and its straight line of best fit were plotted on separate graphs. To determine the cyclic pattern objectively and mathematically, the equations of the straight line were solved for each time that height was actually measured. The difference between the measured heights and the result of solving the straight line equations was termed a deviation. If the recorded measure was above the straight line, that is greater than the magnitude represented by the straight line, the deviation was considered positive, if it was below the straight line, it was considered negative.

The deviations were than analyzed to determine the number of cycles of height growth, according to three criteria for determining cycles. In general, a cycle was considered to be characterized by increasing upward movement followed by decreasing upward movement.

A definite cyclic pattern of height growth from birth to maturity was found in all cases.

These were differences in the patterns of height growth of boys and girls although the patterns of most boys as well as girls showed either three or four cycles.

In all cases the cycle occurring immediately after birth was the most pronounced. The rate of growth was most rapid after birth and gradually decreased for the next two or three years.

Almost all cases exhibited a distinguishable curve or cycle at which might be considered the time of adolescence. This pattern was, however, less obviously curvilinear in some cases.

The individuality of the cyclic patterns of height growth was shown especially during the period between the beginning cycle and the adolescent cycle. During this period of the growth process the rate changed more frequently in some cases than it did in others resulting in a greater number of cycles.

It was concluded that the general cyclic pattern of height growth for the various individuals showed many similarities, although unique characteristics were found, especially between infancy and adolescence. 304 pages. $3.90.

A STUDY OF THE RELATION BETWEEN QUALITY OF EDUCATION AND THE MORALE STATUS OF THE FACULTY

(L. C. Card No. Mic 58-668)

William Kenneth Stosberg, Ed.D.
New York University, 1957

Chairman: Professor Alice V. Keliher

The Problem

The purpose of this study was to investigate what relationship, if any, exists between the quality of educational program and the morale of faculties in schools where the quality of education differs.

A second problem in this investigation was to explore the factors of morale to determine whether these factors appear in different relationship patterns between white and Negro schools in a segregated area, Orange County, Florida.

The study was limited to selected elementary schools in Orange County, Florida.

It was assumed that an indication of morale status could be made by an evaluation of the opinions of teachers and that high morale is more conducive to a high quality educational program than low morale.

This morale study was motivated by the conviction that personnel relations are crucial in the improvement of education; that with the major share of the educational budget chargeable to personnel services, it is vitally important to know what factors influence the welfare and productivity of the staff.

Procedures

Six morale instruments were developed by a group of graduate students in an Educational Personnel Seminar at New York University. These instruments were used to collect data by checklists. The basic morale instrument contained items in the broad areas of: (1) the teacher as a person, (2) the teacher in relation to the community, and (3) the teacher in relation to the staff members.

A rating committee of six members selected schools in Orange County after observation on the basis of "The Growing Edge."[1] They recommended white and Negro schools having high, average, and low quality educational programs.

The instruments were distributed to all teachers and principals in the selected schools. Responses were obtained from 83 per cent of the participating teachers.

Outcomes

The results obtained from the data gathered indicate that the morale tendency of teachers varies with the quality of the educational program in the school. The teachers in schools with the high quality educational programs responded with higher morale tendency scores than the low quality schools in this study.

The findings further indicate that the teachers' attitudes toward the community and their relationships with other staff members influence the morale tendency scores. No evidence was found which indicates that any personal statistics of the teacher as a person, such as sex, marital status, or salary, influence morale.

In the second problem of this investigation, it was found that the morale factors seem to appear in different relationship patterns among the white and Negro schools. The

differences do not appear to be significant, however. Approximately the same differences as were found between the white and Negro schools can also be found when comparing a white school with another white school or when comparing one Negro school with another. Each school seems to have a unique pattern of these factors relating to morale. 248 pages. $3.20.

1. Mort, Paul R., Vincent, William S., and Newell, Clarence, The Growing Edge, New York Metropolitan School Study Council, 1946.

EDUCATION, ADMINISTRATION

PLANNING REORGANIZATION OF THE JUNIOR HIGH SCHOOL EDUCATIONAL PROGRAM, CEDAR RAPIDS, IOWA

(L. C. Card No. Mic 58-1192)

Robert Bruce Allingham, Ed.D.
University of Colorado, 1957

Supervisor: Professor Harl R. Douglass

The plan of secondary school organization in the Cedar Rapids, Iowa, public school system from about 1935 to 1954 has been developed around four six-year junior-senior high schools. In 1954 the community of 70,000 persons approved a bond issue to build two new senior high school buildings, under the premise that the upper three grades of the existing six-year high schools would thenceforth be placed in these new senior high school buildings, and the lower three grades would be organized strictly as junior high schools and housed in the four existing buildings.

The writer was appointed general chairman of a community-wide study intended to provide a basis for recommending a modern junior high school educational program more suited to the needs of the youth of Cedar Rapids of grades 7, 8, and 9 than had been possible under the existing program.

The thesis is a detailed report of the procedures used and the results obtained in attacking the sort of practical educational problem which might confront any number of communities in America.

Approximately 150 teachers, lay citizens, and administrative personnel were organized into (1) an administrative steering committee called the Core Committee, (2) a Central Planning Committee of teachers and lay citizens under the leadership of the administrative personnel, and (3) thirteen subcommittees composed of a teacher-chairman and a number of other teachers and lay citizens.

The study, organized and planned by the general chairman and the Core Committee accomplished the following:

1. Developed a statement of philosophy and defined the special functions and objectives of a junior high school.
2. Planned the design for an educational program suited to the common and special needs of youth of junior high school age.
3. Planned an educational program for young adolescents that would accomplish the things that informed adults in the community considered important in such a program.
4. Encouraged teachers and representative laymen to study the place and possible contributions of each subject area in the complete program.
5. Reviewed the role and possibilities of guidance and student activities in attaining the objectives of the junior high school program.
6. Provided a stimulating opportunity for large numbers of lay citizens and professional school personnel to gain a greater understanding of the physical, social, emotional, and intellectual characteristics of junior high school youngsters and their needs imposed by adolescent peer culture and developmental tasks.
7. Developed plans for serving the special needs of exceptional children of junior high school age.
8. Weighed the possibilities in different types of curriculum approaches such as the core or broad fields, subject areas, and co-curricular activities.
9. Organized a working schedule for implementing the curriculum design and necessary remodeling of the physical facilities, as recommended.

Thirteen subcommittees, working in coordination with the Central Planning Committee, assisted in the preparation of a statement of philosophy and objectives, and developed comprehensive reports for each of the curriculum and co-curriculum areas studied, featured by recommendations for the proposed program. The Central Planning Committee, guided by the general chairman and the Core Committee, received the reports and developed a suggested total educational program which was submitted to a committee of experts in junior high school education for evaluation. The complete report of the study and the report of the evaluation committee were presented to the Board of Education and the community for consideration and approval.

486 pages. $6.20.

THE UNGRADED PRIMARY UNIT IN PUBLIC ELEMENTARY SCHOOLS OF THE UNITED STATES

(L. C. Card No. Mic 58-1196)

Kent Carnochan Austin, Ed.D.
University of Colorado, 1957

Supervisor: Professor Calvin Grieder

The ungraded primary unit, which includes the school years commonly known as grades one, two, and three, without regard for grade designations, has evolved as a method of gearing the early school program more nearly to the needs of each individual child.

The purposes of the study were to get information concerning the development, objectives, operation, professional staff, and public relations of the ungraded primary unit.

The data on which the study was based were obtained from a questionnaire returned by schools or school systems throughout the United States which were known to be using

the ungraded primary program. Extensive supplementary data were also obtained from School District 163, Park Forest, Illinois.

Main objectives reported for the ungraded primary unit included providing for individual differences, providing for continuous, uninterrupted progress, releasing young children from strain and tension, and eliminating failures and needless repetitions.

Professional educators provided the necessary initial inspiration in most cases, but planning and development of the ungraded primary unit were cooperative endeavors which included school administrators, teachers, and parents. The data revealed that it was most common to include, in the first year of operation, all primary children in the entire school system, but more cautious schools initiated the program gradually and included only first year pupils in one selected attendance center.

Social maturity, reading readiness, chronological age, physical maturity, mental age, emotional maturity, and intelligence quotient were all factors considered by responding schools when making original ungraded primary class assignments. The data showed that all schools allowed additional time in the program for slower and less mature pupils, but a majority did not provide for any acceleration for the more capable and mature pupils.

Most schools reported flexible assignment policies wherein a pupil could be moved from one class group to another when the situation warranted such a change. The parent-teacher conference was the most frequent method used to inform parents of a decision to move a child from one group to another.

The data showed that most administrators believed that ungraded primary teachers needed about the same training and skill as a conventional graded-school teacher. However, pleas were directed to teacher training institutions to help prospective teachers recognize and provide for individual differences and to aid them in becoming familiar with the philosophy and operation of the ungraded primary unit.

Ungraded primary teachers were generally expected to teach all areas of the curriculum. Music and physical education teachers were the most commonly provided specialized personnel.

The data revealed that a majority of the schools had specific parent orientation programs. Media included parent-teacher conferences, school visitations by the public, orientation meetings, bulletins, newspaper articles, and parent handbooks.

The operation of 61 ungraded primary units in School District 163 in Park Forest, Illinois was studied in detail. The data showed both parents and teachers were generally satisfied with the operation of the Park Forest Ungraded Primary School.

Conclusions and recommendations included the following points. Thorough study, planning, and discussion should precede the starting of an ungraded primary unit. A continuous analysis should be carried on to assure every child the advantages of the gradeless program. Complete assignment flexibility should be maintained to allow movement of individual pupils from group to group as the situation warrants.

The ungraded primary unit should be recognized as an organizational scheme, not an instructional device, and instructional methods previously assumed or demonstrated to be sound should be continued. Teacher training institutions should familiarize their trainees with the philosophy and operation of the ungraded primary unit.

Both parents and teachers must continually be helped to understand and lend support to the gradeless primary program. 191 pages. $2.50.

PROCESSES USED BY SUPERINTENDENTS FOR THE IMPROVEMENT OF EDUCATIONAL OPPORTUNITY IN SELECTED SCHOOL DISTRICTS

(L. C. Card No. Mic 58-1974)

James Walter Becker, Ed.D.
Temple University, 1958

Statement of the Problem

The major purpose of this study was to examine the processes by which the superintendent fulfills his responsibility for improving the scope and quality of educational opportunity. Other purposes were to describe how these processes function, to evaluate them and to recommend those processes that can be used by the superintendent.

Method and Procedure

Using a selected group of eighteen school districts, depth interviews were conducted with the superintendent of each school district. From these data processes used by the superintendents for improving educational opportunities were described. An evaluation was conducted after the processes had been described to determine which processes could be recommended to superintendents generally. Evaluative criteria were established by making value judgments based on the writer's professional education and work experience. Each criterion was stated in hypothesis form. A further check of each hypothesis was made by studying the literature dealing with leadership.

Summary

1. The findings of the study were divided into processes relative to administrative organization, administrative staff, administrative concern for the instructional program, curriculum development, educational services, the superintendent's personal effort to increase his administrative skills in selected areas, and an evaluation of processes.

2. The literature tends to support the tentative suggested criteria of delegation, participation, flexibility, membership, and communication.

3. Delegation by the superintendent was noted in forty-nine of the fifty-five processes evaluated.

4. Participation was noted in fifty-four of the fifty-five processes evaluated.

5. Flexibility for adjustment was noted in forty-five of the fifty-five processes evaluated.

6. Group membership of the superintendent was noted in thirty-nine of the fifty-five processes evaluated.

7. Lines of communication were noted in fifty-one of the fifty-five processes evaluated.

General Conclusions

1. The superintendent tends to depend on his ability to delegate responsibility to other members of his administrative staff to insure the improvement of educational opportunity.

2. Participation of teachers is limited in most of the processes originating from the superintendent's office.

3. School boards do not participate to any significant degree in planning the improvement of the educational program.

4. No significant evidence was revealed to indicate pupil participation for the improvement of educational opportunity.

5. Lay participation seems to be lacking in the majority of processes used by superintendents for the improvement of educational opportunity.

6. Typically, the building principal enjoys a latitude of freedom in developing the educational program in his building.

370 pages. $4.75.

LEGAL LIABILITY FOR INJURIES SUSTAINED IN THE TRANSPORTATION OF PUBLIC SCHOOL PUPILS

(L. C. Card No. Mic 58-2292)

Gus A. Constantine, Ed.D.
Duke University, 1958

Supervisor: E. C. Bolmeier

Tort Liability of School Districts and Officers

There prevails a principle of law in this country which regards a school district or a school board, in the absence of a statute, immune from tort, and not liable for injuries pupils may sustain. The rule of governmental immunity from liability in tort is deeply rooted in American jurisprudence.

Many courts recommend statutory enactments to achieve a change. Three states -- California, Washington and New York -- have statutes which abrogate the common-law rule for the purpose of protecting governmental agencies from liability. Other states are experimenting with different techniques of meeting the problem.

It is well established that individual school board members, when acting as such, cannot be held personally liable for the negligent performance of the board, unless malice, corruption or failure to act properly is alleged and proven.

Tort Liability of the School Bus Driver

The school bus driver is not protected by the school district's governmental immunity from liability. The courts have been consistent in holding him liable for negligence. To establish negligence, however, there must be a positive showing of failure on the part of the driver in performing his duty.

The bus driver may employ contributory negligence as a defense. If he can show that the plaintiff was guilty of negligent exposure of himself to danger, or of a failure, on the part of the plaintiff, to exercise reasonable care for his own protection, and that such conduct was a substantial factor in bringing about the injury, the court may exonerate the bus driver.

Tort Liability of School Districts Protected with Liability Insurance

Since school transportation has come into existence only twenty-five years ago, legislative policy and judicial opinions on the subject have not yet solidified into a definite pattern. In each state there has been, and continues to be, experimentation, a "hit and miss" situation, and often a patch work of insurance regulations.

Without statutory authorization, no district has the power to expend public tax funds for the purpose of purchasing liability insurance. Many states do not permit the purchase of liability insurance, because they see no real need to be protected from liability, since the state and its agencies enjoy the prerogative of the common-law immunity rule.

The real purpose, of course, in purchasing liability insurance is not to protect the school district, which has no liability to protect, but the injured party.

Most courts may not permit a suit to be initiated and maintained against a school district which is immune from tort, even for determining the amount of the claim for the insurer to pay. This difficulty has been overcome in a few states where they require that the policy of insurance be endorsed with a statement that the insurer waives the defense of the insured's governmental immunity.

Some states are making a sincere effort to compensate pupils for injuries sustained in transportation. For example, Delaware is acting as a self-insurer in pupil transportation. Alabama and North Carolina have established their own state plans for reimbursement of parents for medical, hospital and funeral expenses in connection with injuries or death their children sustain in school bus accidents.

Three states -- California, Washington and New York -- have enacted legislation abrogating their immunity under the common law.

Laws relevant to liability insurance need to be examined, studied and expanded. If liability insurance is to be effective statutes must deny the insurer from pleading the school district's defense of governmental immunity.

216 pages. $2.80.

A COMMUNITY DEVELOPS EDUCATIONAL POLICY: A CASE STUDY

(L. C. Card No. Mic 58-2342)

Luvern L. Cunningham, Ed.D.
University of Oregon, 1958

Adviser: Donald E. Tope

The Problem

The description and analysis of the policy-making process is the subject of this study. This inquiry is particularly concerned with the isolation of regularities in the policy process, with the description and analysis of these patternings, and with the development of understandings about the policy-making process.

Method of Investigation and Research Procedures

The case study method is used in this research. The problem required a method flexible enough to encompass the multi-dimensional quality of the phenomenon under investigation.

Data were collected through unstructured interviews, observation, written records, and library sources. A local school board was the policy-making body under observation. All meetings of this board as well as all meetings of the school district budget committee were observed and written transcripts of the proceedings made. In addition meetings of many other community groups and organizations were attended and written records were made of their deliberations. Interviews were held with all school board members and members of the school administrative staff, as well as other persons who participated in the policy-making process. Observation and interviewing continued over a twelve month period.

The Policy-making Setting and the Policy-making Unit

The multi-dimensional, inter-relatedness of institutions, individuals, and groups that are operative in the policy-making arena assumes intelligibility only when cast in the background of populations, resources, topography, history, traditions, and economy of the community. Policy-making is a social process within an ecological framework. Environmental changes are in process concomitantly with, and because of, social processes; social processes are in turn conditioned by the physical environment.

To gain a more complete understanding of the complex ecological setting in which the policy-making body for education functions, the community is examined in terms of its geography, history, economy, population, and organizational structure. For a more complete understanding of the policy-making body itself, the school board-administrator relationship, the school board's perception of its function, and the backgrounds of individual school board members and administrative staff members are reviewed. Chapters III and IV provide background material for the five case studied of policy-making included in Chapter V.

Five Policy-making Cases

Each of the five policies formulated were formalized or enacted during the period of investigation. Antecedent events significant to the policy-making process were studied and reported when this information was relevant to case understanding.

The first case involves the appointment of a school board member to the school board by the other members of the policy-making body in conformance with the law. The second case is concerned with the formulation of policy in regard to the appraisal of school district property for insurance purposes. Case three involves the decision to install an electric heating system in a new junior high school and the concomitant problem of implementation arising over the choice of either a public or private power supplier. A change in existing policy is the subject of the fourth case: the school board discontinued the allowance of years of military service on the salary schedule for teachers who were not serving in the school district at the time of their induction into military service. In case five, the school board establishes policy about educational television.

Case Analyses and Conclusions

For the purpose of analysis, the policy-making process is conceptualized in five stages, not unlike the stages commonly used in the description of problem solving or scientific method. Within this framework twenty-eight generalizations about the policy-making process have been drawn.

The first stage in the policy-making process is called the initiation stage. Stage two is the definition and statement of the policy problem. Deliberating, bargaining, collecting, and weighing information, and the raising and assaying of policy alternatives make up stage three. The actual selection of a single policy alternative and the enactment of this alternative into policy is stage four. Stage five is the policy implementation period including testing and evaluation of the policy action. 442 pages. $5.65.

AN ANALYSIS OF NON-TEACHING DUTIES OF ELEMENTARY SCHOOL TEACHERS IN THE FIRST-CLASS DISTRICTS OF THE STATE OF WASHINGTON

(L. C. Card No. Mic 58-2136)

Clarence Ivring Daniel, Jr., Ed.D.
University of Washington, 1958

Supervisor: Dr. George D. Strayer, Jr.,

The amount of time elementary teachers spend on extra-classroom tasks greatly influences the amount of time and energy available in the classroom. It was the purpose of this study (1) to determine the duties performed by elementary teachers which require considerable time or contribute little to the instructional process; (2) to investigate teachers' and principals' beliefs concerning who should perform those duties; (3) to determine the degree to which performance of these duties detracts from the effectiveness of instruction; (4) to analyze some of the procedures used to eliminate performance of these duties by the teacher.

The descriptive-survey method of research was used in the study. A free response form was circulated among teachers of grades one through six to develop the list of non-teaching duties to be studied. A questionnaire was developed and sent to selected elementary principals and teachers of grades one through six in the first-class districts of the State of Washington. The 436 responses received and tabulated formed the basis for the study.

Duties commonly performed by elementary teachers were lunchroom supervision; playground supervision; safety patrol supervision; preparation of copies of teaching materials; the securing of supplies for the room; collection of money; supervision of student banking; the taking and reporting of pupil attendance; the recording of pupil information; the recording of health information; the testing of vision and the measurement of height and weight; the giving and scoring of standardized tests; and housekeeping duties.

Teachers were not anxious to assign duties to someone else merely because they required considerable time. Seven duties were thought to be the responsibility of the teacher even though collectively they required over five

hours of the teacher's time each week. They were playground supervision, safety patrol supervision, preparation of copies of teaching materials, the securing of supplies for the room, the taking and reporting of pupil attendance, the recording of pupil information, and the giving and scoring of standardized tests.

Duties the majority of respondents agreed should not be performed by the teacher do not greatly affect the teacher. Two of them (the recording of health information; and the testing of vision, and the measurement of height and weight) were least often performed by the teacher and required the smallest amount of time. The third duty, housekeeping duties, required considerably more time than the other two. All three of them, however, were rated low in detracting from the effectiveness of instruction. Opinion on the other duties was divided between those favoring teacher responsibility, those opposed to it and those undecided. Concerning lunchroom supervision and the collection of money, however, the largest vote was against teacher responsibility, whereas the largest vote of principals favored it. Regarding supervision of student banking, one-third of those opposed to teacher responsibility thought it should be discontinued.

The time required in the performance of the thirteen listed duties was considerable. The median time was about 547 minutes per week or about one and three-quarters hours per day.

Much valuable assistance has been donated by parent volunteers. Much of this was not satisfactory. It was apparent that careful planning and the establishment of adequate guide lines could do much to insure satisfactory results.

There has not been extensive use of paid non-certificated personnel other than those normally found on the school staff (secretary, custodian, lunchroom helpers and nurse). Where it was used, it was reported highly satisfactory.

Respondents reported the most desirable use of non-certificated personnel involved hiring an additional part-time secretary to assist in the clerical work of the building, including service to the teachers. This secretarial help permitted the centralization of such things as collection of money and attendance. 131 pages. $2.00.

A STUDY TO DETERMINE THE PROBABILITY OF RELATIONSHIPS BETWEEN THE EDUCATIONAL AND VOCATIONAL GOALS OF TENTH AND TWELFTH GRADE BOYS AND GIRLS IN OAKLAND AND MACOMB COUNTY PUBLIC HIGH SCHOOLS AND THE EXPRESSED EDUCATIONAL AND VOCATIONAL GOALS OF THE PARENTS FOR THESE CHILDREN

(L. C. Card No. Mic 58-2327)

Edgar L. Grim, Ed.D.
Michigan State University, 1957

The purpose of this study is to determine the probability of relationships between the educational and vocational goals of tenth and twelfth grade boys and girls in Oakland and Macomb County public high schools and the expressed educational and vocational goals of the parents for these children.

This study presents data which reveal the statistically significant relationships in the following hypotheses:

1. There is a probability of a relationship between the certainty of going to college as perceived by tenth and twelfth grade students in Oakland and Macomb County public high schools and their parents' educational aspiration level for their children.
2. There is a probability of a relationship between the vocational goals as perceived by tenth and twelfth grade students in Oakland and Macomb County public high schools and their parents' vocational aspiration level for them.
3. There is a probability of a relationship between the educational attainment level of the parents of tenth and twelfth grade students in Oakland and Macomb County public high schools and the educational goals they hold for their children.
4. There is a probability of a relationship between the educational attainment level of the parents of tenth and twelfth grade students in Oakland and Macomb County public high schools and the certainty of college attendance as perceived by their children.
5. There is a probability of a relationship between the certainty of college attendance as perceived by tenth and twelfth grade students in Oakland and Macomb County public high schools and the educational attainment level required for the vocation of their parents.
6. There is a probability of a relationship between the greater number of children in a family and the parents' educational aspiration for a post-secondary education for their tenth and twelfth grade boys and girls attending Oakland and Macomb County public high schools.
7. There is a probability of a relationship between the greater number of children in a family and the certainty of college education as perceived by tenth and twelfth grade students in Oakland and Macomb County public high schools.

Some of the findings are:

1. The percentage of children very certain to attend college is significantly higher in families where parents aspire to more than four years of college for their children than in families where the parents aspire to only a high school education for their children.
2. The percentage of sophomores and seniors with high vocational goals is greater in families in which the parents have high vocational goals for their children than in families in which the parents have low vocational goals for their children.
3. There is a greater percentage of parents with a college education who have greater than high school educational goals for their tenth and twelfth grade boys and girls than the percentage of parents with less than a high school education.
4. The percentage of tenth and twelfth grade students certain to attend college is higher in families in which the parents have a high educational attainment level than in families in which the parents' educational attainment level is low.
5. The percentage of tenth and twelfth graders certain to attend college is higher in families in which the parent's vocation requires a higher educational attainment level than in families where the parent's vocation requires a lower educational attainment level.

These findings may be used by those people who are interested in developing, at the secondary and post-secondary levels, educational programs which are geared to meet the interests and needs of the people living in the area served by the school. 155 pages. $2.05.

PUBLIC SCHOOL TRANSPORTATION TRENDS AND PRACTICES IN MISSOURI

(L. C. Card No. Mic 58-2346)

Robert Earl Hicks, Ed.D.
University of Missouri, 1958

Supervisor: W. W. Carpenter

Purpose:

The purpose of this study was to show practices in the transportation of public school children in Missouri as well as trends that were evident.

Method of Research:

The sources of data most extensively used in this study were: (1) copies of School Bus Inspection Records, (2) Form C State Transportation Reports, (3) information blanks, returned by superintendents of schools, concerning transportation of public school children is Missouri, and (4) one hundred selected copies of Missouri local school board rules and regulations.

Summary:

The trend in transportation in Missouri was toward the use of a greater number of vehicles. They were of larger seating capacities, more recent models, and less expensive school bus chassis.

With the marked improvement of Missouri rural roads came longer school bus routes. There was an increase in the number of maintenance shops, maintenance personnel, and school gasoline pumps. According to the opinions of the superintendents, a median of 7.7 vehicles should be owned by a district before it would be advisable to employ one or more full-time mechanics.

The trend toward district ownership of buses was quite pronounced in Missouri as well as in the rest of the nation.

The average annual per pupil cost of district-owned transportation was $17.90 less than contracted transportation.

District-owned vehicles were larger than contracted vehicles. District-owned vehicles transported an average of 24.1 more pupils per vehicle than privately-owned transportation.

On the information blanks, 70.3 per cent of the superintendents asserted that in their opinion districts should own the school buses.

The local school board rules and regulations examined indicated that the chief responsibility for planning, supervising and administering the transportation programs was placed on the superintendents of schools.

Not more than 18 per cent of the rules and regulations studied included any one item regarding public school transportation.

The provisions concerning transportation which appeared most frequently were those which pertained to the responsibility for planning and administering transportation programs, transportation charges, chauffeurs' licenses, health certificates, and discipline on the buses.

It was not uncommon to find no more than one or two sentences regarding transportation, and in some cases these were of a general nature.

Conclusions:

It was apparent from the data that there were trends toward more extensive use of public school transportation, toward district ownership of vehicles, toward use of vehicles of larger seating capacities, and toward greater use of school bus repair shops and school gasoline pumps.

Data in this study seemed to suggest that local school boards and superintendents should give serious consideration to district ownership of school transportation vehicles.

There appeared to be little uniformity in printed local school board rules and regulations concerning transportation in Missouri. 189 pages. $2.50.

SCHOLASTIC ACHIEVEMENT AT IOWA STATE COLLEGE ASSOCIATED WITH HIGH SCHOOL SIZE AND COURSE PATTERN

(L. C. Card No. Mic 58-2191)

Irvin Tunis Lathrop, Ph.D.
Iowa State College, 1958

Supervisor: James E. Wert

This study was an attempt to ascertain if the size of the high school from which a student graduated and the pattern of courses taken while in high school had any effect on achievement at Iowa State College. For purposes of this study achievement was defined four ways: (1) Survival-attrition tendency at the end of the first quarter; (2) Graduation-attrition tendency; (3) First quarter quality point average and (4) Cumulative quality point average at the end of a five year period.

The information collected on each of the 1516 students in this study included: size of high school; ACE total raw score; high school grade point average and the pattern of high school courses. The high school pattern of courses was classified into seven categories which were: (1) Mathematics-science, (2) College preparatory; (3) Agriculture; (4) Home economics; (5) Industrial education; (6) Business; (7) Miscellaneous. The statistical techniques employed in this study were those associated with discriminant and regression analyses and analysis of covariance.

Because disproportionality existed between the high school size and the high school course pattern a proportional sample of 180 cases was drawn at random from the total group of 1516 students to test the significance of the relationship between high school size and college achievement. When the high school pattern of courses was equated among the high school categories it was found that the high school size had little relationship with achievement at Iowa State College. The high school course pattern did have an influence on achievement at Iowa State College, regardless of which of the four criteria were used to evaluate achievement.

Analyses made on the total group of 1516 students to ascertain if the high school pattern of courses had any effect on achievement revealed that the pattern had an influence on survival-attrition tendency and quality point

average for the first quarter and on graduation-attrition tendency, but did not have an influence on cumulative quality point average.

Analyses were made on the divisions of Agriculture, Home Economics, Science and Engineering to find if the high school pattern of courses had an influence on achievement. The pattern of courses had an influence on survival-attrition tendency at the end of the first quarter for all divisions except home economics where there were too few student withdrawals at the end of the first quarter to make an analysis. In the divisions of Science and Engineering the high school pattern of courses had an influence on first quarter quality point average. When graduation-attrition tendency was employed as the criterion the high school pattern of courses had an influence on students in the Science Division, but not in the other divisions. When cumulative quality point average was used as the criterion the high school pattern of courses had an influence on students enrolled in the Home Economics and Science Divisions.

The high school course pattern which appeared to insure success at Iowa State College more than any other was the course pattern which included 12 semesters of mathematics and science. The high school course pattern which assured the students the least chance of success was the miscellaneous pattern. 225 pages. $2.95.

A STUDY OF EXTRA-CURRICULAR ACTIVITIES IN THREE SECONDARY SCHOOLS OF BALTIMORE COUNTY

(L. C. Card No. Mic 58-2220)

Richard E. McCaslin, Ed.D.
University of Maryland, 1958

Supervisor: Professor James A. van Zwoll

Purpose: The question is unanswered concerning the proportion of time and degree of emphasis to be allotted to the activities program in secondary schools. Many educators are concerned about the number of times students miss regularly scheduled classes in order to take part in extra-curricular activities. Is there a point at which the pupils participating in these activities achieve less of the curricular offerings than those not so engaged? What factors tend to affect the curriculum balance in Baltimore County?

Procedure: A random sample population of eleventh graders from three Baltimore County high schools listed activities in which they participated and regularly scheduled classes which they missed over a period of one school year. These students were then grouped according to frequency of participation. The Chi Square Method was used to determine whether relationships existing in the population were a function of chance or were statistically significant. The Null Hypothesis was considered refuted when $P<.01$, was questioned when $P>.01<.05$, and was accepted when $P>.05$.

Results:

Those students who missed scheduled classes to participate in extra-curricular activities were found to possess higher Intelligence Quotients, receive higher grades, receive higher achievement test scores, be more active in after-school activities, and have a tendency toward fewer absences than those students who miss scheduled classes less frequently.

Under the circumstances in which classes were missed in order to take part in extra curricular activities in Baltimore County, there is a tendency for the number of missed classes to be reflected in a more positive direct relationship with grades than with standard achievement scores.

The survey showed the following practices in Baltimore County at the time data was collected:

1. Activities requiring students to miss scheduled classes most frequently were music, driver education, sports, student council, decoration for dances, school clerical work, art, drama, and journalism in that order of frequency.

2. Activities attracting students of highest mental ability were committees for dance decoration, student council, and journalism in that order.

3. Students at the smallest school participated more in activities and missed more classes than those in the larger schools.

4. Data suggested three statements in the area of school Absences: As a group, academic students had the fewest absences while commercial students had the most; of the activities investigated those participating in sports had the fewest absences; and, those absent above the population average had lower grades, spent more hours in employment, and tended to participate in fewer activities than students having fewer absences.

Recommendations:

The following proposals might be suggested for consideration in Baltimore County:

1. That the activities program within the regular school day be encouraged and expanded in such manner as will interest a larger percentage of the student body

2. That a study be made of methods which would introduce greater flexibility and adaptability into administrative scheduling policy and practice - investigating such factors as utilization of study periods, specified periods of free choice for individual research or activities

3. That a guidance approach be used, increasing counseling services to facilitate self-discovery of talents, language abilities, non-language abilities, pupil choice, and to mediate a proper balance of activities in accordance with individual needs

4. That a specialist be hired who would coordinate the entire activities program and assist in an evaluation of the program

Summary: To the extent that and under the circumstances in which regularly scheduled classes are missed by students in Baltimore County it can be said that students are not penalized in the performance of those missed classes. On the other hand, evidence seems to indicate that these students were motivated to better accomplishment than were those who missed fewer classes. 173 pages. $2.30.

AN ANALYSIS OF THE LEGAL RESPONSIBILITIES OF STATE DEPARTMENTS OF EDUCATION FOR NONPUBLIC SCHOOLS

(L. C. Card No. Mic 58-2229)

Robert Frederick Will, Ed.D.
University of Maryland, 1958

Supervisor: Clarence A. Newell

The identification and analysis of the legal responsibilities of State departments of education for nonpublic schools constitutes the central theme of this dissertation. The study was undertaken at the request of the Council of Chief State School Officers and with the cooperation of the Council's Study Commission. It was developed as a sourcebook of legislative practice to assist the Study Commission in a project it has undertaken to determine what responsibilities State departments of education should have for the regulation and supervision of nonpublic schools.

The study contains a digest of the State laws in effect January 1957, under which State departments of education are explicitly delegated responsibilities for nonpublic schools. The digest includes constitutional provisions of particular concern to nonpublic schools and those who operate such institutions. The chaptered portion of the study provides a narrative summary and analysis of the digest materials. Pertinent background material relating to the role of the nonpublic school in American Democracy is included.

The study was initiated by a preliminary search of the law in 10 States. Constitutional and statutory provisions having direct bearing upon State department of education responsibilities for nonpublic schools were copied by hand from official State sources and brought together for ready reference. An analysis of this material was made to facilitate the grouping of similar provisions into manageable areas, and the plan for compiling the digest materials was set. When this was accomplished a search was made of the law in the 48 States. The constitutional and statutory provisions compiled under this plan for each State make up the digest or basic data of the study. Important annotations from official State sources and compiler's notes were added to clarify significant sections of the law.

The statutory provisions are identified and analyzed in 12 major areas or subdivisions: (1) Establishment and Supervision, (2) Compulsory Education, (3) Curriculum, (4) Records and Reports, (5) Teacher Certification, (6) Pupil Transportation, (7) Health and Safety, (8) Textbooks, (9) School Lunch, (10) Surplus Property, (11) Scholarships, and (12) Miscellaneous Statutory Provisions. The State constitutional provisions are identified and analyzed in 3 major subdivisions: (1) Public Aid for Nonpublic Schools, (2) Tax Exemptions for Nonpublic Schools, and (3) Miscellaneous Constitutional Provisions. The compilation of digest or basic data materials for each State was checked by the Study Commission member of the Council of Chief State School Officers and verified for publication by his chief State school officer.

There are relatively few explicit responsibilities delegated to State departments of education for the regulation and supervision of nonpublic schools. The school codes of States -- which are administered primarily by State departments of education -- generally provide for the regulation and supervision of public schools. State regulation of nonpublic schools is largely accomplished under laws regulating the activities of private individuals and organizations conducting businesses or charitable undertakings. This provides for desirable freedom in operation for the nonpublic school as a private institution apart from the public school system of the State. Under our system of government, however, there is no question regarding the State's authority to exercise its regulatory powers, subject to the provisions and interpretations of the Constitution of the United States, to insure an educated citizenry. By far the largest number of explicit laws for the regulation and supervision of nonpublic schools as educational institutions are administered by State departments of education.

511 pages. $6.50.

EDUCATION, ADULT

THE IMPLICATIONS FOR A GRADUATE TRAINING PROGRAM IN THE PREPARATION OF PUBLIC SCHOOL ADULT EDUCATION ADMINISTRATORS BASED ON AN ANALYSIS OF ADMINISTRATIVE PRACTICES OF DIRECTORS IN SELECTED MICHIGAN COMMUNITIES

(L. C. Card No. Mic 58-2318)

William Marion Cave, Ph.D.
Michigan State University, 1957

This study was concerned with analyzing the administrative duties and responsibilities of public school adult education directors in selected Michigan communities. A complementary objective was to draw from the findings those which have significant implications for the formulation of a proposed graduate training program for adult education directors.

Twenty-five public school-sponsored programs were selected. The sampling was purposive; selection was based on an expert judgment criteria. The methodology employed by the investigator consisted of (1) the structured interview, (2)direct observation, and (3) informal interviews. The personal interview was focused upon the administrative leader of the local program, the director of adult education. Direct observation of the programs in action was made by the author, while informal interviews were carried on with adult education administrators, adult teachers, custodians, and members of adult education advisory councils.

The major findings of this study were as follows:

1. The adult education programs studied have taken on what might appropriately be termed a "service" character. As such they were highly sensitive and adaptive to the expressed interests of their clientele.

2. The basic administrative orientation of the local adult education directors was "other-directed" or community-centered. The study indicated that, although all directors were generally responsible for program administration and organization, they tended to minimize the relative importance of these internal functions in favor of external, non-institutional factors.

3. Programs were found to be marginal in status. As

a result, directors were insecure and seemed to be somewhat detached from the regular public school staff.

4. The primary role of the adult education director was one of service--service to clientele and to significant community agencies and organizations. The role of service was the basis upon which directors legitimized their program. It was generally concluded that acceptance for most adult education programs in this study was sought on service premises.

5. Public Relations emerged as the most important operational area in terms of program growth and development.

The findings of this study suggested that prospective administrators in the adult education area be given an interdisciplinary kind of training. Implications were that a training program should include the disciplines of Sociology, Psychology, Political Science, and Education.

255 pages. $3.30.

AN EXAMINATION OF ADULT EDUCATION IN VOCATIONAL AGRICULTURE IN THE UNITED STATES

(L. C. Card No. Mic 58-2156)

Carl Oscar Loreen, Ph.D.
University of Minnesota, 1958

Adviser: Milo J. Peterson

Purpose and Procedure of the Study

The purpose of this study was to identify the factors which are associated with variations in enrollment in adult education in vocational agriculture and to explain the decline in adult class enrollment in recent years.

A list of factors was developed from a review of related literature and research. This tentative list of factors was evaluated by a jury of ten teacher trainers and supervisors of vocational agricultural education. Information upon which to validate the final list of fifteen factors was secured from teachers of vocational agriculture, school administrators, teacher trainers, and state supervisors by means of questionnaires. The study was confined to the ten states which were conducting the most extensive adult programs and ten other states in which adult programs were limited or non-existent.

The Results of the Study

Responses were secured from all of the twenty teacher trainers and twenty state supervisors of the states which were included in the study. The study also included 270 schools from which 244 teachers of vocational agriculture and 240 school administrators responded to questionnaires.

Based upon an analysis of the data secured, the factors that seemed to be associated with the development of adult classes in agriculture were:

1. Teacher attitude
2. Training of the teacher
3. Teacher interest
4. Understanding and attitude of the school administrator
5. The attitudes of the teacher trainers
6. The attitude of the state supervisor
7. The local advisory council

It could not be concluded that the following were factors in the development of adult classes:

1. Teaching load
2. Teacher ability
3. Status of the teacher in the community
4. The State Plan for Vocational Education
5. The state reimbursement policy
6. School facilities

Some doubt about the importance of these two other factors remained:

1. Course Content - Method of determining
2. Precedent

Opinions gathered from jurors, teacher trainers, state supervisors, and school administrators place considerable emphasis, as a group, on the teacher and his attitude, enthusiasm, interest, and ability as the factor which serves to promote adult classes most. Collectively, jurors, teacher trainers, state supervisors, and school administrators placed the teachers' time, attitude, ability, and interest as a most important obstacle.

From 1945 to 1950 there was a very rapid rise in the adult class enrollment in vocational agriculture. During the next five-year period, there was a decline in the total enrollment. In 1951 and 1952, there was a change by states in the way enrollment in adult classes was reported. Previously, trainees enrolled in the veterans' training program were reported as evening school students, but this was discontinued with the 1952 report. It seems evident that the decline in the number of persons reported as enrollees from 1950 to 1955 does not show evidence of any basic change in the vocational agricultural education program. This decline reflects a change in the way some states report enrollment in adult classes and does not necessarily indicate a trend downward in the attendance in conventional adult classes in vocational agriculture.

202 pages. $2.65.

EDUCATION, HISTORY

AN ANALYSIS OF ECONOMIC GEOGRAPHY TEXTBOOKS FROM 1891 THROUGH 1956

(L. C. Card No. Mic 58-2021)

William Hayden Cadugan, Ed.D.
University of Pittsburgh, 1958

The purpose of this study was to trace the development of textbooks in economic geography, on a secondary level, through an analysis of 34 textbooks which were written during the period from 1891 through 1956.

Six textbooks written during this period were used to determine the criteria for representative content. Based upon an examination and comparison of these books,

a check list was devised to facilitate the recording and organization of the essential data.

A tentative bibliography of textbooks in economic geography was prepared from the records of libraries, publishers, yearbooks, pamphlets, and periodicals. This general bibliography was then further qualified by reference to the textbook classification in the card catalogs of the libraries of the University of Pittsburgh, Duquesne University, and the Carnegie Libraries of the City of Pittsburgh. This selected bibliography was then validated by reference to the textbook classification, of economic geography textbooks, in the card catalogs of The Library of Congress, Washington, D.C.

The examination and analysis of the textbooks revealed man's progress not only in his adjustment to his natural environment but also in the development of his economic and commercial relationships. For the student, economic geography has presented opportunities for an insight into the economic and commercial resources of the nations of the world. It has provided for the development of skills in map construction and interpretation. It has fostered the ideal of world-wide cooperation and goodwill among the peoples of the earth.

The aim or purpose of the writer of the economic geography textbook ranged from a theme of internationalism to a concept of the social and cultural aspects of the subject. From an ideal of world citizenship, authors favored, in varying degrees, emphasis upon the United States, the development of critical thinking, the vocational values of the subject, and the social and cultural implications of the subject.

There was a general consensus as to the common areas of content of the subject of economic geography. Most authors presented information dealing with such specific topics as the topography, climate, resources, commerce, and population of the nations of the world.

In their presentations, authors tended to favor the regional-commodity or purely regional approaches to the subject matter. These approaches generally favored a regional treatment of the United States and a commodity basic for introduction to the other nations of the world.

As aids in the teaching and learning process, the authors included such primary verbal and visual aids as questions and written exercises, maps, pictures, graphs, diagrams, and charts. Also presented were miscellaneous aids such as prefaces, introductions, tables of content, references, glossaries, appendixes, and indexes.

Definite trends or patterns were apparent as a result of this study. First, economic geography has moved from an encyclopedic presentation of material to a more comprehensive but thought-provoking exposition. Authors have become more concerned, through the passing years, with the quality and quantity of their teaching and learning aids. Finally, the subject of economic geography has appeared to assume more responsibility for a definite contribution towards the development of the social and cultural ideals and attitudes of the American high school student.

201 pages. $2.65.

INFLUENCES AFFECTING THE DEVELOPMENT OF UNDERGRADUATE SOCIAL WORK EDUCATION IN SEVEN MICHIGAN COLLEGES FROM 1920 TO 1955

(L. C. Card No. Mic 58-1458)

Margery Roberta Ross, Ph.D.
University of Michigan, 1957

This study is an analytical review of the emergence of undergraduate social work education in the seven Michigan colleges which are members of the Council on Social Work Education. These institutions are the University of Detroit, Marygrove College, Michigan State University, Nazareth College, Kalamazoo College, Northern Michigan College, and Western Michigan College. The period covered extended from 1920 to 1955. The major thesis which gave direction to this inquiry may be stated as follows: Undergraduate social work education in the foregoing seven colleges has followed the curriculum pattern of graduate social work education; has developed curricula according to changing practices in the field of social work; has curtailed specialization in accord with changing concepts in liberal arts education; and has consistently expanded due to changing economic, political, and social forces in the community.

The writer secured her information by making an extensive exploration of research reports and other types of literature pertinent to her thesis; by studying the official bulletins and catalogs of the seven Michigan institutions; and by personally interviewing the ranking members of the seven social work faculties.

The writer found that each of the colleges was offering a survey course; six included field experience; five were offering community organization; four were offering group work; four were offering public welfare; and two offered child welfare and corrections. The seven colleges have slightly over two hundred majors. Neither the professional organizations nor the graduate schools have had close contacts with the undergraduate social work programs except for Michigan State University where both programs have been offered. The undergraduate programs have been tending to offer fewer courses on specialized services. Most of the colleges have also been following the trend toward survey courses in the humanities, integrated courses in the physical and social sciences and in basic communication skills.

The main conclusions may be very briefly stated as follows:

1. There does not seem to be an orderly, integrated progression from undergraduate to graduate social work education in these Michigan colleges. Although graduates from all of them are admitted to graduate work in this field, the quality of undergraduate professional education is dubious.
2. A trend away from specific and toward generic social work education was evident in casework but not in the over-all concepts of social work.
3. The seven social work curricula have consistently protected their liberal arts content while belatedly incorporating some changes in accord with developments in practice.
4. Political, social, and economic changes seemingly have not directly influenced the development of the seven programs of social work education, except for some curtailment of offerings during the depression of the 1930's.

For instance, only minor modifications in organization and content have been made in the past five years. According to the testimony of the institutional representatives, the seven programs reflect the standards formulated by the National Association of Schools of Social Administration, but to no appreciable degree have they been influenced by the Council on Social Work Education.

The investigator makes no claim that her data are characteristic of any period or institutions other than those represented in this inquiry. 300 pages. $3.85.

THE NATIONAL COUNCIL FOR THE SOCIAL STUDIES: A VOLUNTARY ORGANIZATION FOR PROFESSIONAL SERVICE

(L. C. Card No. Mic 58-2479)

Louis Michael Vanaria, Ph.D.
Columbia University, 1958

This study traces the antecedents of the National Council for the Social Studies and its development since its establishment in 1921. In one aspect it is a case study of the role of voluntary educational associations in shaping and re-shaping, in implementing, and in articulating American education. In a second aspect it is a case study of the slow and still incomplete advance of teaching toward status as a profession.

The history of the Council reflects the organization's chief concern with professional services for established teachers, but also notes its attention to the needs of prospective social studies teachers. The interests and activities of the Council range from the primary grades through graduate school and include all social studies subjects, their interrelationships, and their relationships with other instructional areas. Scholarship and many related research activities, both in academic subjects and in education, changing needs of society and of children and youth, patterns of curriculum organization, problems of teaching and needs of teachers--all fall within the scope of the Council's concern. Although the Council has given greatest attention to the junior and senior high grades it has by no means neglected, especially in recent years, the primary and intermediate grades, programs for the two years after high school, or both the general education and the specialized programs of teachers colleges and graduate professional schools.

As a department of the National Education Association, the Council has its headquarters in the N.E.A. Building in Washington. The office serves as a vital communication center and clearing house, both for the internal operation of the organization and for matters that require a national spokesman for social studies teachers as an occupational group. The office, under the direction of a full-time and salaried executive secretary, maintains liaison with other educational and scholarly associations with common interests and purposes. Many governmental and non-governmental agencies--national and international, concerned with education, scholarship, and citizenship--have sought the cooperation and assistance of the Council.

From its beginning the Council has had a national membership. Gradually it has developed affiliation with regional, state, and local groups. The annual meetings of the Council utilize the services and competencies of the membership, are an important source of practical help for many teachers, and provide opportunities for the sharing of ideas and experiences with invited specialists.

The Council has been an important source of professional publications, including its journal, yearbooks, bulletins, a curriculum series, a "How to Do It" series, and many cooperatively published projects. These publications have contributed to the development of a body of specialized knowledge within the broad field of education.

The voluntary work of Council committees enables the Council to exceed by far the apparent limitations of its financial resources. Committees provide the greatest opportunity for active participation by the membership in the work of the Council.

As in the case of many similar groups, voluntary membership and participation have provided leadership and exerted wide influence in an important part of American education, although the Council is by no means the only voluntary organization that has concerned itself with or influenced the development of social studies teaching.

Whether teaching, especially in elementary or secondary schools, is a profession is debatable; one's conclusion depends largely on how he defines "profession." But the services of the National Council parallel in considerable degree those available to practitioners in fully established and recognized professions. If, as this study concludes, social studies teaching has not yet attained professional status, the influence of the National Council has nevertheless moved it in that direction. 445 pages. $5.70.

SOCIOECONOMIC INFLUENCES IN THE DEVELOPMENT OF AMERICAN ART EDUCATION IN THE NINETEENTH CENTURY

(L. C. Card No. Mic 58-1481)

Earl Albert Weiley, Ed.D.
University of Michigan, 1957

Schools are essentially an instrumentality for the perpetuation of the cultural heritage in the social order in which they exist. The curricula of the schools, therefore, tend to reflect cultural values. This study is an inquiry into the cultural circumstances which helped establish art education as a regular part of the curriculum in the schools of America. Three areas of major concern in this investigation are (1) nationalism, (2) the industrial revolution, and (3) social reform, as factors which contributed to the institution and development of art education as a necessary part of the curricular pattern in the schools of the United States.

In Chapter II the colonial backgrounds with respect to American art, education, and art education are discussed as elements of a handicraft society. The means by which utilitarian folk-arts were perpetuated were compatible and consistent with the economic and educative role of the family. Where art education existed in private schools, it bore the hallmarks of class distinction.

Chapter III is devoted to nationalism of the nineteenth century and the development of art education as a resource to promote national causes, especially those connected with competitive foreign trade. International world's fairs were

in effect barometers to measure national success. These fairs helped stimulate interest in art education and promoted its causes for values other than those commonly considered intrinsic to this area of study.

In Chapter IV the industrial revolution is discussed as a major factor of social change. The division of labor had a direct bearing upon family structure and functions. Schools became increasingly complex along with the rest of society. The need for skilled workers was great. Art education was considered one means for developing industrial skill. The apparent need for skill was so great that art was justified as a subject suitable for all students.

Educational reform as part of the broader reform movements of the nineteenth century is considered in Chapter V. The reform movements were directly attributable to the social upheaval that took place as a result of the industrial revolution. Reformers were concerned with effecting adjustments to this great upheaval. Educational reformers advocated art education as part of the curriculum to help promote personal adjustment in an industrial society that placed great demands in the development of skill. The means by which the educational reformers were attempting to effect personal dignity and individual adjustment were congruent with industrial needs. In this respect the teaching of drawing became a tool of social reform.

Art education in the schools of America is a corollary of social fragmentation and industrial specialization. The significant role of art education in American cultural change is directly related to factors pertaining to economics, technology, social reform, and the ideals of nationalism.

136 pages. $2.00.

EDUCATION, PHYSICAL

SPEEDS OF RUNNING AND RUNNING-AND-DIVING MOVEMENTS TO SHORT DISTANCE TARGETS

(L. C. Card No. Mic 58-2265)

David Canby Bischoff, Ph.D.
The Pennsylvania State University, 1958

This study attempted to determine how certain maximum movement speeds are affected by the type of movement pattern used; more specifically, to determine whether there is a difference between the time required for an athlete to run from a standing start to targets at different distances and different heights, and the time required to reach these same targets by a combination of a run and dive from a standing start. A secondary problem was the determination of whether or not a difference exists between the time required to make hand-contact with a target on the ground from an erect position and the time required to move from this hand-contact position to an erect position.

The experiment was conducted at The Pennsylvania State University during the 1956-1957 academic year. The thirty-three subjects were varsity letter winners at the University.

The apparatus consisted of a suspended frame to which were attached interchangeable target arms that held targets twelve and twenty-four feet apart. Target arms of different lengths supported targets either four or eight feet from the floor.

A subject as he was being tested on the run and on the run-and-dive movement patterns, stood midway between a pair of targets, one to his right side and one to his left, facing a pair of signal lights. Between the signal lights was a photoelectric cell. At the subject's back was a spotlight adjusted to project the shadow of his head over the photoelectric cell. When one or the other of the signal lights was flashed, the subject moved as quickly as possible in the prescribed movement pattern to the target on the side indicated by the light. A chronoscope recorded the time interval between the application of the stimulus and the removal of the subject's head shadow from the photoelectric cell. A second chronoscope recorded the time between the removal of the subject's head shadow from the photoelectric cell and his hand contact with a target. The first chronoscope recorded reaction time and the second chronoscope recorded movement time. Each subject made three running and three running-and-diving trials to each of four pairs of targets. The order of left and right movements was varied for each pair of targets to minimize anticipation. Each subject was permitted to assume the starting position from which he felt he could make the fastest movement.

In testing getting-down movement speed, the subject stood erect with his head shadow over the photoelectric cell and moved as quickly as possible to make hand-contact with a target on the floor at his feet. The chronoscope started with the removal of the head shadow from the photoelectric cell and stopped with the hand contact with the target. On the getting-up movement the subject assumed a starting stance with one hand depressing the target and moved from this position to an erect position as quickly as possible. The chronoscope started with the removal of the hand-contact with the target and stopped when the head shadow covered the photoelectric cell. The reaction time preceding this movement was not recorded. Each subject made twenty-four getting-down and twenty-four getting-up trials.

1. There was not a significant group difference between the movement speeds of the respective patterns, running and running-and-diving. However, several subjects were faster running than running-and-diving and vice versa.
2. Getting-down was a faster movement than getting-up.
3. Reaction time was negatively related to the movement time of the running, and running-and-diving patterns.
4. Reaction time was longer for the nearer targets.

136 pages. $2.00.

EDUCATION, PSYCHOLOGY

THE RELATIONSHIP OF SOCIAL CLASS AND SEX TO SOCIAL NEED SATISFACTION

(L. C. Card No. Mic 58-2296)

Harold Abel, Ph.D.
Syracuse University, 1958

Supervisor: G. G. Thompson

This study was undertaken to examine the relationship of social class, sex and age to the potential satisfaction of a specific social need. The Syracuse Scales of Social-Relations and Group-Structure were utilized as the instrument because these scales overcome many of the inadequacies of previous sociometric approaches. The Syracuse Scales are based on well formulated psychological needs; they provide a rating for every individual in the social group; and they yield stable descriptive statistics which permit intra- and inter-group comparisons.

In a further effort to minimize the major shortcomings of conventional sociometry the hypotheses were derived in advance from a rationale that is psychologically meaningful; and the social need, succorance, was carefully selected to avoid biasing the data.

Social class theory and research findings were integrated with general reinforcement theory to develop the hypotheses. It was postulated that, with regard to potential satisfaction of the succorance need, the mean ratings on the Syracuse Scales would be:

1. higher among members of the same social class than among members of different social classes;
2. higher among members of the upper social class than among members of the lower social class;
3. increasingly higher, with age, among members of the same social class than among members of different social classes;
4. increasingly higher, with age, among members at the same academic level;
5. higher among same sex members than among opposite sex members;
6. increasingly higher, with age, among same sex members than among opposite sex members;
7. higher among same sex members within the same social class than among opposite sex members;
8. higher among same sex members of corresponding different social classes than among opposite sex members.

The sample consisted of 69 fifth graders, 78 eighth graders and 77 eleventh and twelfth graders enrolled in seven classes in Cooperstown Central School, Cooperstown, New York.

The Index of Status Characteristics developed by Warner, et al. was utilized to determine the social placement of each individual in the sample.

The data were analyzed by means of t-tests and led to the following conclusions with respect to social class:

1. The assumption that individuals tend to anticipate greater need satisfaction among members of their own social class was not supported.
2. Respondents at all social levels show a definite tendency to anticipate greatest need satisfaction among members of the upper social classes. There is a trend indicating that preference follows as ascending order from the lwoest to the highest social class potentially available to the individual.
3. No age trends were found to suggest increasing need satisfaction among members of the same social class. It was speculated that if increasing age produces greater anticipated need satisfaction, it will be displayed among members of the upper social levels.

The conclusions with regard to sex status were as follows:

1. Individuals tend to regard same sex associates as greater sources of need satisfaction than cross sex associates. Boys and girls did not appear to differ substantially in their ratings.
2. No evidence was found to support the assumption that with age there is increasingly more need satisfaction among members of the same sex as contrasted to members of the opposite sex. There is no increase in ratings among members of the same sex.
3. The sex factor appears to be of greater significance than the social class factor.

The findings among academic group members reveal no increase in potential need satisfaction from grades 5 to 8. There is a significant increase between eighth and twelfth grades.

The data are restricted because only one community was studied; only the succorance need was investigated; and the ratings were confined to individuals within each academic class. 158 pages. $2.10.

A COMPARATIVE STUDY OF THE PERFORMANCE OF MENTALLY HANDICAPPED AND INTELLECTUALLY NORMAL BOYS ON SELECTED TASKS INVOLVING LEARNING AND TRANSFER

(L. C. Card No. Mic 58-2297)

Kathryn Aspinwall Blake, Ph.D.
Syracuse University, 1958

Supervisor: William M. Cruickshank

The results of past investigations indicate that mentally handicapped children and children of normal or higher intelligence but similar mental ages show certain similarities and differences in response to academic achievement and psychometric tests. The intent of this investigation was to inquire whether some of these relationships were reflected in direct learning and transfer of learning behavior.

Selected for subjects were 30 intellectually normal and 30 mentally handicapped boys who were matched individually on the basis of mental ages within the range of 7 years 11 months to 11 years 8 months. The mean mental age of both groups of subjects was 10 years 0 months. The normal subjects had a mean chronological age of 10 years 2 months; the retarded subjects, 15 years 0 months. The mean intelligence quotients of the two groups of subjects

were 99 and 70 respectively. In order to meet the requirements of the transfer design the total normal and retarded groups both were divided into experimental and control subgroups of subjects who were matched individually on the basis of mental age, chronological age, and intelligence quotient.

The three tasks, designated as the card sorting, paired associates, and principle tasks, were assumed, in turn, to reflect sensorimotor learning, rote learning, and the discovery and application of an underlying principle. Each task consisted of two forms: a training form and a transfer form. The type of responses required by the two forms of the task remained identical; the stimuli were varied along a dimension of similarity. The training form of each task was administered to the retarded and normal experimental subgroups of subjects. The transfer form was administered to all four subgroups.

On the basis of some of the data reported in past comparative investigations and certain a priori considerations hypotheses were proposed about the relative direct learning and transfer of learning performance of mentally handicapped and intellectually normal children with similar mental ages. With three exceptions these hypotheses were fully supported by the data obtained in the administration of the three tasks. The first exception involved mean rote learning performance. Here the hypothesis was only partially supported. The second exception was in mean performance in discovering a principle. There was no support for this hypothesis. The third exception was in the transfer of sensorimotor learning. Since the participating subjects did not show a significant amount of transfer of learning on the card sorting task, it was not possible to evaluate the hypotheses about relative mean performance and variability. Thus, the obtained data appear to justify the following conclusions.

1. The mean performance of mentally handicapped subjects in direct sensorimotor learning is significantly superior to that of intellectually normal subjects with similar mental ages.
2. The mean performance of intellectually normal subjects in direct rote learning is probably superior to that of mentally handicapped subjects with similar mental ages.
3. The variability of mentally handicapped subjects in the three types of direct learning performances--sensorimotor learning, rote learning, and the discovery of a principle--does not differ significantly from that of intellectually normal subjects with similar mental ages.
4. The rate of learning of mentally handicapped subjects in the three types of direct learning performance--sensorimotor learning, rote learning, and the discovery of a principle--does not differ significantly from that of intellectually normal subjects with similar mental ages.
5. The mean performance of mentally handicapped subjects in the transfer of rote learning does not differ significantly from that of intellectually normal subjects with similar mental ages.
6. The mean performance of mentally handicapped subjects in the transfer of a previously discovered principle does not differ significantly from that of intellectually normal subjects with similar mental ages.
7. The variability of mentally handicapped subjects in the transfer of rote learning does not differ significantly from that of intellectually normal subjects with similar mental ages.
8. The variability of mentally handicapped subjects in the transfer of a previously discovered principle does not differ significantly from that of intellectually normal subjects with similar mental ages.

These generalizations are limited to the populations from which the samples were selected and the types of learning performance assessed under the conditions of this investigation. A wider application will have to await subsequent study of other populations of subjects.

307 pages. $3.95.

AUTHORITARIAN TRENDS IN PERSONALITY AS RELATED TO ATTITUDINAL AND BEHAVIORAL TRAITS OF STUDENT TEACHERS

(L. C. Card No. Mic 58-2266)

Joseph Anthony Del Popolo, Ed.D.
The Pennsylvania State University, 1958

The purpose of this study was to investigate the relationship between an individual's personality structure and his opinions and attitudes toward pupil-teacher relationships and his observable behavioral traits in a classroom setting. The concept of personality adopted for the investigation was that of the authoritarian personality structure.

As a test of authoritarianism a 177 item scale was adapted from Webster, Sanford, and Freedman. A high score on the scale indicated that a subject was high in authoritarianism. This instrument was referred to as the A Scale.

The measure of attitudes toward pupil-teacher relationships selected for use was the Minnesota Teacher Attitude Inventory, Form A, by Cook, Leeds, and Callis. This 150 item inventory was designed to measure those attitudes of a teacher which predict how well he will get along with pupils in interpersonal relationships. A high score implied ability to establish harmonious relationships with pupils. This instrument was referred to as the MTAI.

An Observation Check Sheet for recording the classroom behavioral traits of the test subjects was constructed by the author. This 75 item instrument was designed to follow the test subjects into student teaching for the purpose of investigating the relationship of attitudes and actual practice. The higher a score a subject would get on the Observation Check Sheet, the better his relationship with pupils was presumed to be.

The procedure followed employed a pilot study group, an experimental group, and a control group. In all, 366 sophomore and junior students in a New York State teachers college participated in the study. All test subjects were pre-tested on the A Scale and MTAI at the beginning of the sophomore year and post-tested on the same two instruments at the end of the junior year. The Observation Check Sheet was completed for each subject during student teaching.

The statistical analysis rendered the following results:

1. Negative correlations of -.59 and -.66 were found between A Scale and MTAI scores.
2. Negative correlations of -.62 were found between A Scale and Observation Check Sheet scores.
3. Positive correlations of .47 and .41 were found between MTAI and Observation Check Sheet scores.
4. A comparison of the upper and lower fourths on the A Scale with respect to Observation Check Sheet scores produced a t ratio of -6.95.
5. A comparison of the upper and lower fourths on the MTAI with respect to Observation Check Sheet scores produced a t ratio of 3.35.
6. A t ratio of 6.52 was found between pre- and post-A Scale scores and 2.01 between pre- and post-MTAI scores for the experimental group.
7. A t ratio of 5.30 was found between pre- and post-A Scale scores and 4.18 between pre- and post-MTAI scores for the control group.
8. Reliability coefficients for the MTAI, A Scale, and Observation Check Sheet were found to be .97, .92, and .96 respectively.

Consideration of the data permitted the drawing of the following conclusions.

The investigation lent support to the main hypothesis that a significant relationship exists between an individual's personality structure and his opinions and attitudes toward pupil-teacher relationships and his observable behavioral traits in a classroom setting.

Authoritarian students tend to get significantly lower scores than equalitarian students on an inventory of attitudes and opinions about pupil-teacher relationships. These differences were interpreted in terms of the dissimilar psychological orientations of the two groups.

Authoritarian students tend to display behavioral traits during student teaching which imply an inability to establish harmonious pupil-teacher relationships. On the other hand, equalitarian students tend to display behavioral traits which are felt to be conducive toward the establishment of harmonious pupil-teacher relationships.

The student teaching experience with its day-to-day contact with pupils and school problems tends to influence a little the idealistic approach toward children held by student teachers. 126 pages. $2.00.

AN EXPERIMENTAL STUDY OF THE RELATIONSHIP BETWEEN ELECTROENCEPHALOGRAPHIC IMAGERY VARIABLES AND PERCEPTUAL-COGNITIVE PROCESSES

(L. C. Card No. Mic 58-2438)

Henry Walter Drewes, Ph.D.
Cornell University, 1958

THE PROBLEM

The purpose of this study was to investigate the role of "imagery" in various perceptual and cognitive processes. The study was further designed to assess intelligence and its relationship to "imagery." It was expected that the inordinate dominance or absence of visual "imagery" in an individual's perceptual make-up would greatly influence the efficiency with which certain mental tasks could be solved.

SAMPLE

The individuals for this study were volunteers drawn primarily from courses in general psychology at Cornell University. The nature of the study imposed stringent restrictions on the sampling, resulting in an incidental sample composed of three groups with presumably different visual "imagery" processes.

PROCEDURE

Individual EEG recordings were taken from the occipital lobe while the subject underwent two tasks. Task A consisted simply of the alpha rhythm response to light with eyes open for two minutes and eyes shut for two minutes. Task B consisted in the alpha rhythm response while the subject was allegedly attempting to visualize and "mentally" manipulate geometric figures on a two dimensional plane for two minutes. Subsequently, each individual's alpha rhythm was analyzed according to frequency and amplitude. The subjects whose quantitive estimate of alpha diminution on Task A was 95 per cent or more when the eyes were open and 80 per cent or more when the eyes were shut, and whose quantitative estimate was 90 per cent or more on Task B, were designated visualizers. The subjects whose quantitative estimate of alpha diminution was approximately zero when the eyes were shut and 20 per cent or less when the eyes were open, and whose alpha diminution was 10 per cent or less on Task B, were designated non-visualizers. These were the groups of primary concern although individuals of another group whose alpha diminution fell between the visualizers and the non-visualizers was also designated. These individuals were categorized as responsives. The visualizer group consisted of 27 individuals, the non-visualizer group of 21 and the responsive group of 54 individuals.

The individuals qualifying for one of the above groups were given three psychological tests to determine any significant differences. The first test was the Wechsler Adult Intelligence Scale, the second the Rorschach Inkblot Test, and the third the Spatial Visualization test of the Guilford-Zimmerman Aptitude Survey.

FINDINGS

It was found that the visualizers did significantly better at the one per cent level of confidence than the non-visualizers on the Performance scale, Digit Span, Digit Symbol, and Block Design subtests of the WAIS. They also did significantly better at the five per cent level of confidence on the Object Assembly subtest. Of 17 variables tested on the Rorschach, the visualizers produced significantly more FK responses than the non-visualizers at the one per cent level of confidence. They also produced significantly more W and FC responses at the five per cent level of confidence.

It was found that the non-visualizers did significantly better at the one per cent level of confidence than the visualizers on the Similarities and Arithmetic subtests of the WAIS. They did significantly better at the five per cent level of confidence on the Picture Completion subtest. The non-visualizers also did significantly better at the five per cent level of confidence than the responsives on the Picture Arrangement subtest. Of the 17 variables tested on the Rorschach the non-visualizers produced significantly more FM and cF plus c responses at the one per cent level of confidence. They also produced significantly more K responses at the five per cent level of confidence.

The visualizers did significantly better at the one per cent level of confidence on the Spatial Visualization test of the Guilford-Zimmerman Aptitude Survey.

No significant differences were found among the experimental groups with respect to intelligence as measured by the WAIS. 288 pages. $3.70.

THE ATTITUDES OF EIGHTY-FIVE WOMEN IN THEIR MIDDLE YEARS TOWARD THEIR NARROWING ROLE AND THE RELATIONSHIP OF THESE ATTITUDES TO THEIR CONTENTMENT

(Publication No. 21,689)

Gertrude Dorothy Zemon Gass, Ph.D.
University of Michigan, 1957

Unrest among American women today has become increasingly a subject of comment. An assumption widely held is that this unrest is related to women's narrowing role. This investigation is concerned with the attitudes of eight-five women toward their narrowing role and the relationship of these attitudes to their over-all contentment.

Eighty-five women comprised the group studied. These women had participated in a discussion on leisure time as part of an all-day institute sponsored by the Jewish Welfare Federation of Detroit. They were considered a sample of the one thousand women who attended this institute.

Data were collected from these women by means of an interview schedule administered by professional interviewers, trained in the use of nondirective techniques. The interview schedule was concerned with five areas: (1) homemaking, (2) pregnancy and childbearing, (3) child-rearing, (4) leisure time, and (5) contentment. To quantify the material for statistical analysis, a scoring plan was devised which made use of a comparison of respondents' statements against criterion statements. Approximately three hundred sample statements were given to four judges for classification into degrees of expressed satisfaction. Those statements about which the majority of the judges agreed were accepted as the criteria. The women's responses were then compared with these criteria, scored, and translated into numerical weights. Simple and multiple correlations were computed between the respondents' contentment scores and their satisfaction scores for the remaining four areas.

The major findings, based on a majority of the eighty-five respondents, may be stated as follows: (1) They received satisfaction from homemaking, but this satisfaction did not depend on the retention of homemaking functions. The women who expressed the greatest homemaking satisfaction were predominantly free from homemaking duties. (2) They received satisfaction from the idea of having children, but their pleasure only rarely extended to the actual physical experience. (3) Their satisfactions and dissatisfactions from child-rearing were more or less in balance; however, they expressed pleasure at being freed from child-rearing duties. (4) They enjoyed their leisure time despite the fact that they often considered their use of it a problem. (5) They expressed a fair degree of contentment, but this contentment was often a result of their being allowed to avoid pressures and competition. (6) The problem most frequently named was the responsibility of rearing their children. (7) They would like to have achieved more education.

The rank order of strength of statistical association between the four areas and contentment was: (1) leisure time, (2) homemaking, (3) pregnancy and childbirth, and (4) child-rearing. The coefficients of correlation between leisure time and homemaking with contentment were more than .50, which was considered high for purposes of this study, whereas those between pregnancy and childbirth, and child rearing, were less than .50, and thus were considered low for our purposes.

It was concluded that, for the population which this group represents, (1) contentment would not be facilitated by widening the wife-mother role, (2) a return of home-centered functions and a stress on educational programs which emphasize homemaking skills would be inappropriate, (3) an attempt to confine them more closely to the home would increase discontent, and (4) promotion through educational and guidance techniques of more productive and creative use of their leisure time would enhance contentment.

220 pages. $2.85. Mic 58-5044

INFLUENCE OF LEARNER'S CHOICE ON THE EFFECTIVENESS OF ALTERNATE MODES OF PRESENTATION OF LEARNING MATERIAL

(L. C. Card No. Mic 58-2153)

Newton Elder James, Ph.D.
University of Minnesota, 1958

Statement of the Problem

This investigation is an extension of previous studies which have sought to determine the most effective mode for the presentation of learning material in the classroom. It is directed to the solution of the continuing instructional problem of the United States Air Force and the materials and subjects used are those which are present in the actual training situation. The unique feature of the study lies in the application of self-concept theory of personality to the selection of individuals for training by specific methods. The primary question which is asked is "Do individuals who are given learning material by the mode of their preference learn better than those individuals who are given the material in a mode unlike their choice?"

Procedure

Approximately 500 basic airmen were given a written pretest of aviation information and queried as to their preferred method of receiving learning material of a type which is encountered in Air Force technical training. Three choices were offered, viz. reading, lecture, or no preference. Subjects were divided into groups according to their choices and each of the three groups so formed were divided randomly into two equal-size groups, one of which was given a reading presentation and the other a tape-recorded lecture. The material was identical except for the mode of presentation. Immediately following the presentation of the learning material, all subjects were tested with the sample multiple-choice test factual items. Scores were recorded for each subject on the Armed Forces Qualification Test and used in the formation of groups which were compared in an analysis of variance. A 2 x 2 x 3 factorial design was used which employed the following variables:

1. Mode of presentation (reading or lecture)
2. AFQT score (upper or lower half of sample)

3. Preference of mode (reading, lecture, or no preference)

Results

Findings were in agreement with many of the previous studies which indicated the superiority of the reading method for the presentation of complex learning material. A statistically significant (.05 level) interaction between choice and mode of presentation was noted, but detailed comparison of specific groups revealed that the learning of those which received the material in the preferred mode was not significantly (.20 level) different from that of the groups that received the material in the mode unlike that chosen. The variation in scores on the posttest which could be attributed to differences in general intelligence (as indicated by AFQT scores) was over fifty times as great as that which could be attributed to the choice and mode interaction factor.

Conclusions

In comparison with other factors affecting the learning situation, whether or not a person gets his favored mode of presentation of the material appears to be relatively little importance. However, before the interaction of learners' choice and mode of presentation is dismissed as having no practical application, an effort should be made to identify the specific component of the statistically significant interaction found in this experiment. 182 pages. $2.40.

AN EXPERIMENTAL STUDY OF THREE METHODS OF TRAINING INDUSTRIAL EXECUTIVES IN READING IMPROVEMENT

(L. C. Card No. Mic 58-2423)

Dan Henley Jones, Ph.D.
Michigan State University, 1956

Objectives

This study was concerned with the evaluation of certain methods of training industrial executives in reading improvement. Its major purpose was to determine the relative effectiveness of certain techniques used in reading training programs. This determination was made immediately after the training, and again eight months after the completion of training. Specifically, an attempt was made to answer the following questions:

1. Can industrial executives be trained to read more effectively?
2. If reading efficiency is improved, to what extent is the improvement retained?
3. Which of three commonly used methods of training is most beneficial?

The Sample

The sample consisted of fifty-six executives employed by the AC Spark Plug Division of the General Motors Corporation. These subjects were placed in four groups each consisting of 14 persons. The groups were equated on the basis of small sample statistics according to the following criteria: reading rate, reading comprehension, reading index, mental alertness scores, age and vocabulary.

Methodology

The four groups of executives were subjected to reading training under one of the following conditions:

Group A was trained with the aid of all available commercial equipment including the Harvard Films, the group tachistoscope, the reading accelerator, and the individual tachistoscopic trainer.

Group B was trained with the aid of only the group type commercial equipment including the Harvard Films and the group tachistoscope.

Group C was trained without the aid of any commercial equipment.

Group D received no training and served as the control group.

These groups were tested, equated, and then subjected to the training program. They were trained for sixteen hours exclusive of testing. Training sessions were held for two hours each week for a total of eight weeks.

Statistical analysis was limited to t ratio tests of significance of differences between and within groups. All analyses included recognition of the principle of conservatism in small sample statistics. The null hypothesis was used throughout the study. The major analyses made in the study included the significance of changes made in the various aspects of reading ability as a result of training, and retention of those changes as measured eight months after the completion of training.

Findings

1. Industrial executives can be trained to read more effectively. Significant improvement was found in all training groups after training in the areas of rate, comprehension and index.
2. The benefits achieved by each of the three methods employed in this study are generally retained over an eight-month period. No significant loss of skill was found between the testing immediately after training and testing eight months later. The level of reading ability eight months after training was significantly above the level at the beginning of training.
3. No one method was shown to be most beneficial. There were no significant differences between training groups either immediately after training or again eight months later. There were, however, very significant differences between each training group and the control group.

102 pages. $2.00.

METHODS OF STUDYING SELF-CONCEPTS OF TEACHERS

(L. C. Card No. Mic 58-2267)

Frances Mary Moroney, Ed.D.
The Pennsylvania State University, 1958

The Problem-This study was an investigation of the practicability and feasibility of some methods for studying the self-concepts of teachers.

Procedures-In finding approaches for studying the teachers' self-concepts several methods were utilized:

1. the observation-interview
2. the projective-type data:
   Self-Portrait
   Who Am I?
   The Psychological Autobiography
   Thumbnail Sketch of the Student Liked Best
   Thumbnail Sketch of the Student Liked Least
   Sentence Completion
3. The Edwards Personal Preference Schedule (EPPS)

Thirteen teachers selected from among the teachers in the schools of State College, Pennsylvania, and from among the teachers of neighboring communities were asked to complete the projective-type data and the EPPS. Each teacher was observed by the writer for a period of two one-half days. An interview followed the observation.

From the interview material the writer selected statements about a person's self-concept. These items, totaling over four hundred, were then catalogued according to the EPPS variables and rephrased in order to increase their usefulness. The statements were then submitted to a panel of judges who were asked to find whether or not there was evidence for these statements in the interview and projective material. Reliability checks were made on a sample of these categories and subjects.

Findings-The method of judging statements from the interview and projective data offered a possible approach to the study of teachers' self-concepts.

The interview and projective data provided a measure for the study of teachers' self-concepts.

A significant relationship between the Self-Portrait, and the EPPS scores was found in only one category, dominance. There was a tendency for the teachers to rate themselves higher in dominance, intraception, achievement, autonomy, affiliation, nurturance, change, and heterosexuality, and lower in agression, endurance, abasement, succorance, deference, order and exhibition. The correlations between the EPPS and the Self-Portrait measures were generally low.

When the scores of the thirteen teachers on the EPPS were compared with the scores of the standardizing population of the EPPS, significant differences were found. Higher scores were found for intraception and deference, and lower scores for dominance and heterosexuality.

The case study approach was found to be useful in gaining a composite view of the self-concepts of each teacher.

Conclusions-The EPPS, the interview, and projective data were found to be both practical and feasible for studying the teachers' self-concepts.

This study has indicated that the self-concepts of teachers may be investigated through the use of interviews based on observations of the teachers, projective-type data, the EPPS, and a self-rating on the categories of the EPPS.

Implications for Further Research-Further research might profitably investigate the difference between teachers and the rest of the population in the categories of the EPPS to determine whether the differences found here are typical of teachers as a group.

These techniques might also be used to relate the self-concepts of teachers to their behavior in the classroom and ultimately to the effectiveness of their teaching.

Additional research in the use of these techniques might well be carried on in teacher-education and in public school supervision. 196 pages. $2.55.

A STUDY OF CERTAIN FACTORS AFFECTING THE UNDERSTANDING OF VERBAL PROBLEMS IN ARITHMETIC

(L. C. Card No. Mic 58-2242)

Richard Post, Ph.D.
Columbia University, 1958

Problem-solving in arithmetic has fascinated both psychologists and specialists in arithmetic because of its difficulties for students. The concern of the present investigation has been to study factors of the problem that affect the understanding of a verbal problem in arithmetic. A verbal problem was considered a quantitative situation described in words in which a definite question had been raised that required a quantitative answer, but in which the arithmetical operations that led to the answer to the question had not been explicitly indicated. By carefully examining previous research in the field, an attempt was made to avoid the weaknesses of the earlier studies. The conclusions of many of these past inquiries were affected by (1) defining somewhat vaguely the factors of the experiment, (2) basing the results of the experiment on correct solutions of problems rather than on correct interpretations of problems, and (3) overlooking the possibility of interactions between the factors.

The six factors of the study, chosen on the basis of a study of past research in the field were:

Factor A. Size of Numbers
Factor B. Superfluous Numerical Data
Factor C. Familiarity of Setting
Factor D. Number of Steps
Factor E. Type of Operation
Factor F. Symbolic Terms

Every factor was defined at two levels. Verbal problems were constructed which systematically varied the two levels of each factor with respect to the two levels of every other factor on a strict combinatorial basis. Since there were two levels for each factor, a total of 64 (2^6) different factor combinations appeared in the experiment. In order to gather additional information on the factors, two test items were written for each of the 64 factor combinations. The problems were administered to 176 fifth and sixth grade students of the Green Village Road School of Madison, New Jersey, and the Glenwood Landing School of Glen Cove, New York. Although the students were asked to solve the problems, only the children's choice of numbers

and operations were considered in the scoring of the test items.

The basic design of the experiment was a confounded factorial design that utilized tests of eight verbal problems. Through an analysis of variance procedure the significance of the main effect of each factor and several minor order effects of interactions between the factors were determined.

The results of the study indicated that the three most important factors affecting the understanding of verbal problems were the type of operations involved in the problem, the familiarity of the problem setting, and the presence of superfluous numerical data in the problem. The study did not yield any conclusive results on the effects of the remaining three factors although there was some evidence to indicate that the effect of symbolic terms was negligible. Of the thirty-one interactions between factors that were tested, only the interaction between the number of steps in a problem and the type of operations involved in a problem appeared to affect the understanding of verbal problems.

The important effect of the type of operation on understanding verbal problems pointed up a major weakness in problem solving. That is, the difficulty encountered with the operations probably stemmed more from the lack of comprehension of the concepts than from lack of ability in the performance of skills. Therefore, it would appear that more emphasis must be placed on the teaching of concepts by individuals doing research in arithmetic education.

131 pages. $2.00.

A STUDY OF RELATIONSHIPS BETWEEN THE ACHIEVEMENT NEED LEVEL OF INDIVIDUALS IN A GROUP AND RATINGS GIVEN TO THE MEMBERS OF THE GROUP FOR THE POTENTIAL SATISFACTION OF THIS NEED

(L. C. Card No. Mic 58-2308)

Carmen John Scalea, Ph.D.
Syracuse University, 1958

Supervisor: Eric F. Gardner

On the premise that the role of the school includes recognition of pupils' social needs and planning for their realization, it would seem that adequate diagnosis of social satisfactions and dissatisfactions among the members of a group would be warranted. This writer has chosen achievement need (n Ach), as defined in Murray's schema of needs, as a point of departure for investigating the following question: Are persons with a high n Ach level and persons with a low n Ach level differentially sensitive to variations in the perceived potential of the various group members for the satisfaction of this need?

It was hypothesized that in a n Ach situational setting the sociometric ratings received from the high n Ach individuals would reflect a greater sensitivity to the IQ, achievement level, n Nur level, and n Suc level of the rated persons than would ratings from the low n Ach individuals; furthermore, that the ratings received by persons with higher IQ, higher achievement level, higher n Nur level and lower n Suc level from the high n Ach individuals would be significantly higher than those from the low n Ach individuals.

IQ values were obtained by means of the California Test of Mental Maturity, and the Iowa Test of Basic Skills yielded achievement level indexes. A "Guess Who" instrument, constructed by this investigator, provided indexes of n Ach, n Nur, and n Suc, with the 75th and 25th percentiles being used as cutting points to identify high n Ach individuals and low n Ach individuals, respectively. The Syracuse Scales of Social Relations, a new sociometric technique which is built around specific psychological needs, was utilized to assess need satisfaction potential.

In the case of each group correlation coefficients were computed between median ratings received by each member from the high n Ach individuals and the IQ score of the rated member; also, correlations were obtained for each member using median ratings received from the low n Ach individuals. The two correlation coefficients thus obtained for each group tested for significant difference. This entire procedure was repeated for the other three factors: achievement level, n Nur level, and n Suc level.

The other analytical approach involved computing for each group the mean of median ratings received by the more intelligent pupils (above the 50th percentile in IQ) from the high n Ach individuals and the mean of median ratings from the low n Ach individuals; then, t's were computed to test for significant difference between these means. This entire process was repeated for each of the other three factors.

The results with respect to the IQ factor contained few instances of significant difference in favor of the hypotheses; however, the findings did tend to be analagous to those of past investigations which show a positive relationship between IQ and sociometric standing. Similarly, in regard to achievement level the evidence was in the main insufficient for the tenability of the hypotheses although almost unanimously inclined in that direction. Again, these results could be seen to parallel those of past research.

Almost all of the evidence regarding n Nur tended to support the hypotheses, but in only a few instances was statistical significance attained. The results in connection with n Suc were, on the whole, conflicting and inconclusive.

The implications of these results for education might be interpreted to suggest the desirability of grouping based on rather broad bands of ability. Also, helping pupils towards improvement of achievement and towards cultivation of a sensitivity to the needs of others would seem to be a worthwhile endeavor in terms of increasing a pupil's sociometric status in a situational setting involving n Ach.

134 pages. $2.00.

A PROPOSAL FOR A PROGRAM OF GUIDANCE SERVICES FOR TURKEY WITHIN A FRAMEWORK OF PUPIL PERSONNEL SERVICES

(L. C. Card No. Mic 58-2224)

Hasan Tan, Ed.D.
University of Maryland, 1958

Supervisor: Professor Richard H. Byrne

The problem of this study is to develop a ten-year program for the establishment of guidance services in the

public elementary and secondary schools in Turkey under the prevailing conditions in Turkish education.

In order to establish a frame of reference for the proposed plan, pupil personnel work and guidance work are defined through examining the literature and basic services that make up pupil personnel work and guidance work are identified. To base the proposed plan on facts and prevailing conditions, the problems and needs of Turkish education are identified.

The proposed plan is considered in three main stages: a) the Preparatory period, b) the Beginning period, and c) the improvement and development period. During the first period a pupil personnel bureau is established in the Ministry of education. This Bureau is proposed to assume leadership and supervision of preparatory activities for organizing guidance programs. Among these activities are summer workshops to train counselors, professional publications to disseminate a guidance point of view, experimenting with proposed guidance procedures in two pilot schools, selection of five "experimental" provinces which will undertake organized guidance activities in thier respective "experimental" schools in the second period of the project - the fifth year. The following initial activities are proposed to organize guidance services: a) in-service education, b) surveys of student problems, c) case study and case conference, and d) group activities, i.e. homeroom, student clubs, orientation and special days.

Basic guidance services - individual inventory, information, counseling, placement, and follow-up - are discussed.

Administrative organization for guidance services are proposed at five different levels: a) Bureau of Pupil Personnel and Special services in the Ministry of Education, b) Provincial Pupil Personnel Bureau, c) guidance office in the individual school, d) District Guidance Bureau, and e) Sub-district Guidance Bureau. The personnel in a guidance program is also discussed and sources for training of guidance workers are suggested.

Various evaluation studies of guidance services are examined, and the following categories of criteria are proposed for the evaluation of the guidance services in the ten-year project: a) presence or absence of services and facilities, b) use of the services, c) effect of the services, and d) opinion of the pupils and experts regarding the services.

In order to give a comprehensive picture of the total project, a time table for the flow of the proposed activities for each year of the project is provided.

Finally, in relation to the ten-year project, four research plans are proposed: a) a national survey of education, b) evaluation of the ten-year project, c) job analysis, counselors' duties, and d) guidance needs of village schools.

257 pages. $3.35.

EDUCATION, TEACHER TRAINING

A STUDY OF THE STUDENT TEACHING PROGRAM IN ELEMENTARY EDUCATION AT THE UNIVERSITY OF OMAHA

(L. C. Card No. Mic 58-1198)

Hollie B. Bethel, Ed.D.
University of Colorado, 1957

Supervisor: Professor H. H. Mills

This study was undertaken to obtain an appraisal of the strenghts and weaknesses of the elementary student teaching program of the College of Education at the University of Omaha. The procedures involved an extensive review of literature, the development and distribution of four questionnaires, one of which was submitted to the prior judgment of a panel of jurors, presentation of the assembled data, drawing conclusions, and making recommendations. Questionnaires were submitted to student teachers who were doing part of their student teaching during the fall semester of 1956, elementary education graduates of 1954, 1955, and 1956, principals in whose schools these graduates were teaching or had taught, and cooperating teachers in the public schools with whom either graduates or student teachers have carried on their student teaching. Two hundred eighty-six, or eighty-eight per cent of the four groups submitted data.

The survey included these areas which have been designated as important in the preparation of elementary teachers: pre-student teaching experiences with adults and children, student teaching experiences within the classroom, school system and community, individual conferences with the cooperating teacher and the university supervisor, and group conferences of student teachers.

Professional laboratory experiences which were participated in by student teachers and graduates prior to student teaching included experience with children's organizations in the community, observation and participation in public schools, and studies of individual children. The opinion was expressed by both these groups and by jurors that additional experiences closely allied to university courses and more critically supervised and evaluated should be included in the teacher education program.

Orientation to student teaching in the public school through visits to the school, early acquaintance with the cooperating teacher, and attendance at pre-school workshops in addition to information as to university and school policies was recommended by jurors, student teachers, and graduates. The present plans for off-campus student teaching, time allotment, and placement of student teachers were approved by respondents, with the added suggestion of jurors that the University consider the establishment of a campus laboratory school or use an affiliated public school for pre-student teaching laboratory experiences and experimentation.

Student teachers and graduates reported many opportunities for direct, first-hand experiences with children during their two semesters of student teaching. Commonly reported by both groups and by cooperating teachers were caring for routines, planning with and for children, observing, teaching various groups, and carrying through consecutive periods of work. Teaching with no other adult present, and assuming the responsibility for the program

for a complete session were frequently named as their most valuable experiences by both student teachers and graduates. A need was shown for additional opportunity to work with long-range plans, to aid children in developing skills of self-discipline, to work with ability groups, and be given even more extensive opportunity to teach the entire group in the absence of the classroom teacher. One area in which experience should be increased is that of whole-school and community activities. Relatively few opportunities have been provided in these areas. The time factor, especially in a half-day program of student teaching appeared to be the greatest limitation.

Individual and group conferences, both with the cooperating teacher and the university supervisor, and the guidance of student teachers through visitation were highly regarded, although more time for conferences was desired by student teachers and cooperating teachers.

On the basis of the findings of this study it is recommended that consideration be given to providing full-time rather than half-time student teaching, supervised pre-student teaching laboratory experiences, to the cooperative preparation of a student teacher handbook, and to the possible addition of a laboratory school. 340 pages. $4.35.

A STUDY OF THE ACADEMIC AND PROFESSIONAL PREPARATION OF JUNIOR COLLEGE TEACHERS OF PHYSICAL SCIENCE

(L. C. Card No. Mic 58-2361)

Kendall Scott Kinerson, Ph.D.
Michigan State University, 1957

The purpose of this study is to determine what would appear to constitute the most appropriate training for prospective junior college physical science teachers as seen by junior college teachers and administrators, and by a group of the outstanding leaders in the field of junior college education.

Questionnaire responses describing the current status of their formal training and non-academic work experience, and making recommendations regarding these same aspects of the preparation of prospective teachers, were obtained from 186 junior college physical science teachers located in 124 junior colleges in thirty-seven different states. Responses which listed recommendations for the training of prospective teachers were also obtained from 104 administrators in these same colleges, and from thirty-eight national authorities in the field of junior college education.

The findings pertaining to the status of training showed: (1) a median of eight years of junior college teaching experience; (2) qualification to teach in two, and often three, of the physical sciences; (3) preparation in an undergraduate major and two minors, and a graduate major and one or two graduate minors; (4) the equivalent of two years of study in one foreign language; (5) preparation equivalent to about fifteen semester hours in Education courses; (6) an average of eleven semester hours in research by about half of the teachers; (7) practice teaching experience in a high school; (8) a bachelor's degree held by 9 per cent of the teachers, a master's degree by about 77 per cent of them, and a doctorate by 14 per cent; and (9) an average of nearly four years of non-academic work experience which the teachers rated as being of considerable value to them as physical science instructors.

The major recommendations for the training of these teachers include a two-year graduate program which is oriented toward the development of an understanding of the technical-industrial applications of physical science and toward an interest in teaching rather than one in research. The program should prepare a student to teach in at least two physical science areas. The following specific details are recommended: (1) a thirty to thirty-six semester hour major, and two twenty-credit minors at the undergraduate level; (2) a twenty-credit major and two ten-credit minors at the graduate level; (3) fifteen hours in a specified list of Education courses at the undergraduate level; (4) six to twelve credits in Education courses at the graduate level; (5) from nine to twelve credits in the social sciences and a similar number in the humanities at the undergraduate level; (6) a teaching internship in a junior college; and (7) the acquisition of some non-academic work experience in locations where practical applications of the physical sciences are being put to use. 194 pages. $2.55.

A STUDY OF MUSIC EDUCATION GRADUATES FROM THE UNIVERSITY OF MINNESOTA (1947-1956) WITH PARTICULAR REFERENCE TO THEIR PARTICIPATION AND PERSISTENCE IN THE PROFESSION

(L. C. Card No. Mic 58-2162)

Gale LaVerne Sperry, Ph.D.
University of Minnesota, 1958

This study is related to the over-all problem of teacher supply and demand. Answers to these general questions were sought:

Do University of Minnesota music education graduates who are in the profession of music teaching differ in certain respects from those who left or did not enter the profession? Do any factors serve as predictive measures of the degree of persistence these subjects show in the profession of music teaching?

The factors of participation (Study A) and persistence (Study B) were investigated separately. The population for both studies consisted of the 249 men and women who took the Bachelor of Science Degree in Music Education during the period June 1, 1947 to June 30, 1956.

Study A is a descriptive comparison of the group of music education graduates who were teaching music at the close of the 1956-57 school year with those who were not teaching music at that time.

In Study A, differences between these two groups were found to be significant at the five per cent level in the following cases:

1. A greater proportion of men were still teaching music.
2. Men music teachers have a greater number of their immediate family engaged in teaching.
3. Men music teachers were stronger in their intentions to remain in their present profession.
4. Men music teachers showed a higher regard for the excellence of their latest music departments when compared with music departments in other schools of comparable size.

A greater proportion of men music teachers:
5. took additional graduate work after having had some professional work experience.
6. felt that school music instruction should not be denied any beginning student.
7. indicated income is regular, appreciation by superiors is shown for good work, and work provides opportunity to share in making decisions.

A greater proportion of men not teaching music:
8. did not take the courses "The School and Society" and "Health of the School Child."
9. indicated their income is adequate for the responsibilities of the position, and advancement is made on the basis of merit.
10. were residing outside of Minnesota.

A greater proportion of women music teachers:
11. had been members of the University Bands.
12. had been members of a University professional sorority.
13. reported higher salaries.

A greater proportion of women not teaching music:
14. had participated in University Chorus or allied vocal groups.
15. were married.
16. participated in a civic organization in 1956.
17. spent more time at extra work outside of their principal occupation.
18. felt that school music instruction should not be denied any beginning student.
19. Men and women music teachers belonged to a greater number of professional organizations.
20. Married men music teachers reported a greater number of children.
21. Married women not teaching music reported a greater number of children.

Study B consisted of a comparison of those University music education graduates during the period 1947-1955, who had shown a certain degree of persistence in the profession (more than two years) with those who had not been persistent. This categorization of the subjects was made without regard for their present classification as a music teacher or not a music teacher.

Significant differences were found in the following cases:
1. A greater proportion of men were found to be persistent.
2. A greater proportion of persistent men and women were still teaching music at the close of the 1956-57 school year.

Persistent men:
3. were graduated from smaller high schools.
4. were graduated from the University at a more advanced age.

Non-persistent women:
5. ranked higher in their high school class.
6. participated to a lesser extent in professional sororities and student religious organizations while at the University.
7. A larger proportion of persistent women participated in the University Bands. 268 pages. $3.45.

EDUCATION, THEORY AND PRACTICE

A COMPARISON OF INSTRUCTION IN VOCATIONAL AGRICULTURE CLASSES FOR YOUNG AND ADULT NEGRO FARMERS IN SOUTH CAROLINA

(L. C. Card No. Mic 58-2268)

Gabe Buckman, Ed.D.
The Pennsylvania State University, 1958

The study was conducted to determine (1) the extent to which the out-of-school young men and adult farmers were being reached through organized instruction in vocational agriculture, (2) the differences in farming status of young farmers and of adult farmers, (3) the differences in enrollment in the general phases of the instructional program by young farmers and adult farmers, and (4) the differences in approved practices carried out in the farm mechanics phases of the instructional program by young farmers and adult farmers.

The data were obtained through personel interviews with fifty randomly selected Negro teachers of vocational agriculture in the State of South Carolina in 1956. The findings and interpretations follow:

1. There were 808 young farmers and 1,218 adult farmers who received systematic instruction in vocational agriculture in the fifty schools in 1956.
2. Twenty-eight per cent of the young farmers and 43 per cent of the adult farmers were land owners.
3. In both the young farmer and adult farmer groups there were comparatively large enrollments in seven phases of the instructional program selected for their value as general education related to the seven cardinal principles of education.
4. In farm shop work, farm power and equipment, and farm buildings and conveniences activities in the instructional program, the young farmers tended to have higher percentages of students who carried out approved practices than the adult farmers.
5. In soil and water management activities the largest percentages of approved practices carried out by young farmers and adult farmers, 60 and 78 per cent respectively, were in the use of crop rotation. Twenty-eight per cent of the young farmers and 37 per cent of the adult farmers practiced strip cropping.
6. The least number of approved practices carried out by both young farmers and adult farmers in any one of the five farm mechanics areas was in the farm electrification area of the program. Only one out of four selected approved practices was carried out by more than 20 per cent of the men enrolled.
7. From 20 to 30 per cent of the teaching time with young farmers, and from 15 to 35 per cent of the teaching time with adult farmers was spent in farm mechanics activities.

The general conclusions and recommendations were:

1. Both young farmers and adult farmers were interested in increasing knowledge and proficiency in

their present occupations as evidenced by their enrollment for instruction in the classes.

2. The activities planned and carried out in vocational agriculture seem to draw out-of-school persons into the program. Fifty-two per cent of the young farmers enrolled and 79 per cent of the adult farmers enrolled had had no previous in-school training in vocational agriculture.
3. Young farmers and adult farmers are becoming concerned about the improved treatment that should be given the soil and are carrying out the practices planning for conserving soil and water.
4. Young farmers and adult farmers are developing skills that are much needed in the care and repair of their farm machinery and equipment.
5. A worthwhile emphasis in the further development of the farm shop phase of the program may be indicated in the fact that 50 per cent of the young farmers and 37 per cent of the adult farmers carried out practices in operating the power equipment in the school shops, yet only 6 per cent of the young farmers and 10 per cent of the adult farmers have established home farm shops.

It was recommended that more teachers use advisory committees along with members of the classes in planning programs and that full attention be given to the differences in needs of the two groups in the several phases of instruction. 100 pages. $2.00.

POST SCHOOL ADJUSTMENT OF FORMER SPECIAL EDUCATION PUPILS WITH IMPLICATIONS FOR CURRICULAR REVISION

(L. C. Card No. Mic 58-2269)

Jack C. Dinger, Ed.D.
The Pennsylvania State University, 1958

Background and Statement of the Problem:

This study investigated certain aspects of the educational, military, occupational, economic, and social adjustments of former pupils of classes for the educable retarded in order to utilize any resulting curricular or administrative implications for more effective preparation of future students of such classes.

Population and Procedure of the Study:

From 1211 former retarded pupils, 614 names were selected who met the following criteria: 1 to 10 years in special classes, left school from a secondary special class, and had an IQ between 50 and 85. A questionnaire, which requested residence, marital and occupational data was sent to 421 parents of former pupils for whom current addresses were located. Intensive interviews with 100 of the 333 responders and their employers provided the data for this study. This sample of 81 males and 19 females had a mean chronological age of 27.0 years and a mean intelligence quotient of 70.5. This selected group contained those who: answered the questionnaire, were living in Altoona, and who were employed. The results are not necessarily representative of all former retarded pupils

Some Specific Findings of the Study:

1. Did not admit former membership in special classes. (39%)
2. Had received post school training. (47%)
3. Of the eligible males, 64.7% served in military services, received promotions, were assigned responsible jobs, received additional schooling and were in combat.
4. The majority of jobs held by this group have been unskilled and semi-skilled types.
5. The school aided only 2% of these subjects to secure their current jobs.
6. Annual wages of the group ranged from $365 to $7800 with a mean of $3281 and a standard deviation of $1350.
7. Of the group, 55% were married and had a total of 79 children. The mean IQ of the 17 children enrolled in school was 101.8 and the mean IQ of the spouses was 95.4.
8. A sufficient income to make them self-supporting was earned. (82%)
9. None are on relief and only 6% had ever been on relief since leaving school.
10. Worthwhile suggestions were offered by the subjects for training future retarded students in homemaking and financial skills.
11. Civic activities: 34% had voted, 86% were church members, and 22% participated in civic projects.
12. Of the jobs currently held: 33% require no reading; 95% require no arithmetic above third grade level; 69% require no writing; 91% require no geographical knowledge greater than city and county.

Conclusions and Recommendations:

1. Administration should develop a functional curriculum for the retarded, leading to the diploma, designed to meet their occupational, civic, social and personal needs as identified by this study.
2. The curriculum should provide for the retarded until age 18.
3. On-the-job training, post-school placement and a continuing follow-up program are essential and should be supervised by special teachers provided with adequate time and facilities.
4. Administration must interpret the potentialities of the retarded to faculty, community and employers in order to develop acceptance and cooperation in dealing with this group.
5. Colleges should develop a positive attitude in teacher-candidates toward the retarded by acquainting them with their adjustment potential and their fulfillment of community needs.
6. The curriculum should provide for those knowledges, personal characteristics and skills found necessary for locating and maintaining the types of jobs currently held by former special pupils.
7. Labeling and isolated placement of retarded pupils should be avoided.

8. Cooperative curricular planning should be a function of all school and community personnel involved with training the retarded. 224 pages. $2.90.

THE RELATIONSHIP BETWEEN SUCCESS IN TEACHING VOCATIONAL AGRICULTURE AND ABILITY TO MAKE SOUND JUDGMENTS AS MEASURED BY SELECTED INSTRUMENTS

(L. C. Card No. Mic 58-2270)

Elwood M. Juergenson, Ph.D.
The Pennsylvania State University, 1958

Purpose

The purpose of the study was to investigate the relationship between the success of a teacher of vocational agriculture and his ability to make sound judgments as indicated by scores on three published tests. An essential consideration was that of obtaining an adequate measure of performance or success in order to have a standard with which the tests of judgment could be compared.

Method

Forty seven senior students of vocational agriculture in four high schools were asked to evaluate their own benefits derived from the program in terms of a list of questions based on the objectives of vocational agriculture as outlined by the Agricultural Education Service, U.S. Office of Education. Three types of evaluators, the principal, supervisor, and teacher educator, rated the success of the teacher in the four schools using a theoretical salary scale. The evaluation instrument was adapted from a previous study made with industrial arts teachers. Correlations were made between the evaluator scores and the student scores.

Two groups of teachers were used to investigate the relationship of judgment to success. Fifty experienced teachers in the central region of California and twenty new teachers from the entire State comprised the groups. The success of each teacher was rated on the theoretical salary scale by a principal, a supervisor, and a teacher educator.

Each teacher was given a mental ability test and three selected tests designed to measure problem solving ability in specific areas. The areas were those requiring abilities in mechanical, social, and logical reasoning situations. Mental ability was appraised by the Wonderlic Personnel Test, Form A. The instruments used to measure the three judgment areas were the Bennett Mechanical Comprehension Test, Form BB, the Moss-Hunt Social Intelligence Test, Revised Form, and the Watson-Glaser Critical Thinking Appraisal, Form Am. Correlations between sucesss and each test and between combinations of tests were determined. Null hypotheses were tested at the .05 level.

Findings and Interpretations

The success ratings of the teachers of vocational agriculture by each pair of evaluators correlated significantly. Student ratings of the effectiveness of the teachers correlated significantly with success ratings made by the three evaluators. The correlation of .64 between the student rating and the principal rating was higher than the correlation of the student rating with that of the supervisor or teacher educator or any combination.

A correlation of -.29 was found between the Wonderlic Personnel Test scores and the success ratings of the 50 experienced teachers by their principals. A significant relationship was not found between the success of experienced teachers and their ability to solve problems in judgment situations as measured by each of the three tests. A significant multiple correlation was not found between success and scores on the three judgment tests or between mental ability and scores on the judgment tests.

A significant correlation was not found between the principal ratings and Wonderlic Test scores of the new teachers. Comparisons made between success ratings and the three judgment scores for the new teachers were substantially the same as found with the experienced teachers.

The results showed the three judgment tests to be of little value as indicators of teacher success. The mechanical, social and logical reasoning tests may have value in counseling individual students preparing to become teachers but not as predictors of subsequent teaching performance. Ratings by the administrators provided the best indication of the success of teachers of vocational agriculture. 83 pages. $2.00.

A PROPOSED ENRICHMENT PROGRAM FOR RAPID-LEARNING AND GIFTED INTERMEDIATE GRADE PUPILS BASED ON RESEARCH REPORTED HEREIN AND ON EXPERIMENTATION IN THE LA MARQUE, TEXAS, PUBLIC SCHOOLS

(L. C. Card No. Mic 58-2175)

L. V. McNamee, Ed.D.
University of Houston, 1958

Brief statement of the problem. This investigation proposes an instructional enrichment program for intermediate grade pupils on the basis of a synthesis of data from related research, existing school practices, expert opinion, superintendent attitudes, prevalent teacher methods, pupil interests, and La Marque, Texas, school experiences of the investigator.

Method employed. Library resources of five universities and an extensive personal library were used in gathering data; philosophies and attitudes of twenty-five superintendents were secured by questionnaire and, in some instances, personal interview; fifty-six classroom teachers from nineteen schools responded to queries concerning method; two hundred five rapid-learning and gifted pupils were personally interviewed to secure interest data; and extensive files of experiences in La Marque, Texas, provided necessary information for the problems of the investigation.

Summary of findings of the investigation. Even though research data is inconclusive, it appears that the support for special classes tends to be somewhat stronger than a similar advocacy for heterogeneous classes in promoting academic, personal and social growth. However, research evidence shows that acceleration, enrichment, segregation, and combination methods can all produce better education for rapid-learning and gifted children when given a chance.

Six of the nationally recognized special programs for

rapid-learning and gifted children are found in Cleveland, Ohio; Quincy, Illinois; Hunter College Elementary School, New York City; Berkeley, California, Public Schools, Colfax School, Pittsburgh, Pennsylvania; and Birmingham, Alabama, Public Schools. From these schools came ideas for foreign language study, science, use of pupil interests, partial segregation, pupil selection, field trips, current events, and creative writing.

"Expert" opinion contributed the following ideas, content, and methods to this proposal;

1. Hollingworth's plan for instruction in biography;
2. Witty's suggestions concerning extension of reading interests and oral reading;
3. Blough's recommendations concerning science enrichment content;
4. Spitzer's procedures for strengthening the arithmetic program;
5. Horn's and Kottmeyer's proposals concerning a study plan in spelling;
6. Bullis' program for improving inter-personal relationships;
7. Baker, McKee, Jones, Mireles and Croslin, Freeman and Ayres, Wulfing, Terman, Girard, Burrow, and Wilson presented other ideas.

Twenty-five public school superintendents contributed the following attitudes which affected the proposals of this investigation: (1) rapid-learning and gifted pupils are being neglected; (2) present classroom procedures are inadequate; (3) some segregation would be approved by over two-thirds of the superintendents; and (4) leadership training was considered desirable and practical by over 90 per cent of the administrators.

Fifty-six teachers in the Texas Gulf Coast Area were responsible for the following recommendations.

1. A need exists for an enrichment program apart from what is possible in the regular classroom; thus, the part-time segregated special classes of this investigation fill this need.
2. Extensive reading, as advoated by the teachers, became a major area of enrichment in this proposal.
3. In view of the great diversity of instructional practices advocated by the fifty-six classroom teachers, leadership, it seemed to the investigator, was needed in selecting major instructional techniques to be employed with rapid-learning and gifted children. As a consequence, this investigator outlines, in considerable detail, methods of instruction in the proposed study areas.

Group interview sessions and interest questionnaires completed by two hundred five rapid-learning and gifted pupils in eight Texas Gulf Coast Schools contributed the information given below:

1. The great interest evidenced in extension reading, handwriting, and spelling prompted inclusion of all three areas in the proposed enrichment program.
2. Foreign language study, biography, and personality problems -- composite choices five, seven, and nine -- were selected for major study areas.
3. Science topics led write-in items by a wide margin in spite of the fact that one of the twenty-six items on the pupils' questionnaire was a science topic.

Experiences of the investigator in working with rapid-learning and gifted pupils, in La Marque, Texas, Public Schools during the past five years, have resulted in the following beliefs which have influenced the proposals of this investigation:

1. Rapid-learning and gifted children enjoy and profit from an intensive study of biography;
2. Spanish is one of the most popular and useful enrichment areas;
3. Writing, directing, and acting in plays, constituted the enrichment activity of greater interest among sixty-three La Marque pupils;
4. Speech activities are ideally suited to the capabilities and needs of rapid-learning and gifted pupils;
5. Rapid-learning and gifted pupils seem to sense the importance of engaging in lessons designed to help them understand themselves and others to a greater degree;
6. Part-time segregated classes do not pose a major problem in social relationships within the school;
7. Rapid-learning and gifted pupils in La Marque are above average in physical and emotional characteristics;
8. School principals profit, in their role as instructional leaders, from participation in a program for rapid-learning and gifted pupils.

After utilizing data from the seven sources mentioned above, the investigator proposed a partially segregated enrichment program for the upper 15 to 20 per cent, intellectually, of the intermediate grades, which included units of study in (1) biography; (2) science and arithmetic; (3) public speaking and dramatic activities; (4) human relations; (5) news analysis and dissemination; (6) conversational Spanish; (7) creative writing, handwriting, and spelling; and (8) library extension reading.

199 pages. $2.60.

AN EXPERIMENTAL STUDY COMPARING THE EFFECTS OF THE MULTIPLE TEXTBOOK APPROACH AND THE SINGLE TEXTBOOK APPROACH TO ELEMENTARY SCHOOL SOCIAL STUDIES

(L. C. Card No. Mic 58-1237)

Frederick William Schneider, Ed.D.
University of Colorado, 1957

Supervisor: Associate Professor Kenneth L. Husbands

The central purpose of this study was to experimentally determine whether significant differences in achievement could be obtained by pupils using the multiple textbook approach to elementary school social studies as opposed to pupils using the single textbook approach.

Subjects in the experiment were fourth grade pupils at

Eugene Field Elementary School, Maryville, Missouri, during the 1956-57 school year. The children were divided into a heterogeneous control group of fifty pupils using the single textbook approach, and a similar heterogeneous group of fifty pupils using the multiple textbook approach. Drop-outs during the course of the experiment reduced to forty-seven in each group the number of children whose scores were finally analyzed. Two teachers were assigned to the control group and two to the experimental group.

Test results were analyzed at the end of the experiment by the technique of analysis of covariance. The mean achievement and the variability of each group of pupils were computed, and the differences were tested for significance at the five per cent level.

Data were collected from a series of tests; identical tests were administered as a pretest and as a final. The Otis Self-Scoring Test of Mental Abilities was administered only at the beginning of the experiment for the purpose of equating the two groups for intelligence. Also employed were the California Tests in Social and Related Sciences, a teacher-made achievement test constructed by the experimenter and covering the scope of the material covered, and, finally, the Behavior Preference Record, by which the subjects were tested in six behavior characteristics.

That both the experimental and control groups made gains in achievement during the experiment is evident in t-test results for the total California battery, the teacher-made test, and each of the tests in the behavior preference group. A t of 7.92 for the control group and of 7.49 for the experimental group in the total California battery indicate highly significant achievement. On the teacher-made test, the control group's t of 9.79 and the experimental group's t of 8.77 indicate achievement by both groups which was highly significant.

The t tests for the mean gains in the various characteristics tested in the preference battery indicated the following results: the experimental group's gains were significant in cooperation, friendliness, responsibility, and critical thinking, while the control group's gain was significant only in friendliness. Neither group's gains were significant in integrity and leadership.

The differences in mean gains on the various tests in which the experimental and the control groups were compared were not significant at the five per cent level. When the groups were subdivided into mental abilities groups, however, the superior mentality pupils in the experimental group showed gains in the areas of history and related sciences that were significant at the ten per cent level over those in the control group. This causes skepticism of the null hypothesis of no difference in achievement for pupils in upper mentality levels using multiple textbooks.

The results of this experiment indicate that in the areas of subject-matter acquisition and improvement in behavior preference, it makes little difference whether pupils use multiple textbooks or a single text. However, in the areas of work-study skills and understandings, as measured subjectively in this experiment, the multiple textbook approach appears to hold more merit and potential.

218 pages. $2.85.

THE ADEQUACY OF AUTOGENOUS WELDING FOR VOCATIONAL AGRICULTURE SHOP INSTRUCTION IN MODERN FARM MECHANIZATION

(L. C. Card No. Mic 58-2271)

Franklin Harrell Smith, Ed.D.
The Pennsylvania State University, 1958

Purpose. The study was designed to compare the use of autogenous welding equipment with the forge in farm mechanics instruction in vocational agriculture. Autogenous welding equipment included the electric arc welder, the carbon arc torch, and the acetylene welder. The four basic skills involved were horizontal welding, vertical welding, bending, and tempering. The experiment was planned to test whether there is a difference between the use of autogenous welders and the forge in the (1) time required to become familiar with the common techniques of operation, (2) time required to prepare work and to adjust and ready the equipment, (3) time required to make selected projects, (4) quality of the projects completed. and (5) preference ratings by the students.

Method. Outlines were prepared for an eight hour basic course and for a sixteen hour course. A teacher workshop was conducted to insure a uniformly high quality of instruction. Six West Virginia schools carried out the experiment in 1956-57 with 81 sophomore students.

Records were kept of the time required to learn the basic skills, the time needed to prepare to work with each type of equipment, and the time used in making each project. The quality of the projects was determined by use of a set of scale values. The student preference ratings were obtained. A paper and pencil test of information was administered as a pre-test and as a post-test. The Otis Quick Scoring Test of Mental Ability and the Bennett Mechanical Comprehension Test, Form AA, were used for covariance analysis. Null hypotheses were tested at the .05 level.

Findings and Interpretations. Students who completed the sixteen hour course had significantly higher scores on the vertical welding project than students who had the eight hour course. A similar difference for flat position welding approached significance at the .05 level. No differences associated with the length of the course were found for bending or tempering projects made with any of the kinds of equipment.

Significantly fewer minutes were needed to prepare to work with each of the kinds of autogenous welding equipment than with the forge.

The mean time used by the students to make the bending project was 58 minutes after sixteen hours autogenous welding instruction, 67 minutes after eight hours autogenous welding instruction, and 91 minutes after having had the eight hour forge instruction course. The forge-trained students required significantly more time. There was no significant difference in time required to make the tempering project by use of any of the kinds of equipment.

The mean score of the students who made the bending project with oxy-acetylene equipment was significantly higher than for the students who used the carbon arc torch or the forge. There was a significant .54 correlation between the quality scores of the students for flat and vertical welding.

The mean student preference ratings for working with the electric welder and with the oxy-acetylene equipment

were significantly higher than for the carbon arc torch or the forge.

On the information post-test, the mean scores of the students who had each of the three basic courses were not significantly different. The increases from the pre-test were not significant. The instruction given was successful in teaching the four basic skills but did not result in large gains in the information called for in the test.

It was concluded that teachers who provide sixteen hours of basic instruction in the use of autogenous welding equipment will have allowed sufficient time for the development of the four basic skills. While there are some jobs for which the forge is particularly well adapted, schools generally may substitute the sixteen hour autogenous welding course for the common combination of forging and welding instruction at the introductory level in farm mechanics.

124 pages. $2.00.

BASES FOR IMPLEMENTING A LOCAL HOMEMAKING PROGRAM

(L. C. Card No. Mic 58-2332)

Wilma Warner, Ed.D.
Michigan State University, 1957

This study was undertaken to secure informational background for the homemaking teacher as a basis for preplanning a homemaking education program. A series of instruments were developed to obtain the needed facts.

The basic instrument for securing the facts was the questionnaire. The study was confined to three off-campus training centers affiliated with the same college. All schools used in the study were located in the same state, Illinois, and all the schools had approved vocational homemaking programs. A check list of information was submitted to a jury, composed of 15 administrators and 30 homemaking teachers, for their opinions. The jury likewise indicated the sources from which the information could be obtained. These persons were selected by the State Superintendent of Public Instruction and the Chief of Home Economics Education. On the basis of the replies five instruments were designed: (1) a pupil opinionaire, (2) a parent opinionaire, (3) the interview schedule for administrators, (4) an interview schedule for local residents, and (5) a community observation check list.

The following procedures were used to supply the data: (1) examining research findings and literature, to learn more about communities and the information homemaking teachers might desire as a basis for building a functional program; (2) obtaining the opinions of the selected administrators and homemaking teachers regarding the items of importance to a homemaking teacher and where this information could be secured; (3) preparing the five instruments; (4) trying the instruments in the three teacher training centers; (5) interviews with pupils and parents; and (6) testing of the five instruments by beginning teachers.

Revisions were made in the instruments after use in a rural community, an industrial area, and in an industrial-rural area. The instruments were checked in three off-campus communities and in 5 communities by five beginning homemaking teachers. Ninety-three per cent of the 351 pupils enrolled in the homemaking classes in the communities and forty-eight per cent of the 155 parents of these pupils cooperated with the study. Follow-up interviews were held with 30 parents and 60 pupils in the three communities. The 5 beginning teachers reported a total return of 95 per cent of the 294 pupils and 83 per cent of the 215 parents of these pupils in the five communities. Fifteen student teachers, 6 supervising teachers, 10 administrators, and 55 key persons in the three communities assisted in the testing of the instruments prepared in this study.

The findings indicated that the instruments prepared did secure the needed information for pre-planning the homemaking education program and the following conclusions are justified:

1. Parents are a good source of information for a homemaking teacher to use to learn more about the community and are willing to supply the needed information.
2. Pupils can contribute and are willing to furnish information usable to a homemaking teacher for use in planning the homemaking education curriculum.
3. Administrators and key persons in the community have information and are willing to share data which are helpful to a homemaking teacher in planning the curriculum.
4. The five instruments used in this study can be used advantageously to readily secure information for program planning.
5. The five instruments were usable to first year homemaking teachers.
6. The five instruments served as a motivating device in promoting inquiry about the community.
7. It is probable that additional information would need to be secured in developing a homemaking curriculum.

This study appeared to have implications that these instruments might be utilized by supervisors, teacher trainers, teachers, and administrators as devices for learning more about communities where they are and/or where pre-service trainees may teach.

The investigator recommends that additional research be carried on in order to clarify the present findings: (1) utilization of this set of instruments with beginning teachers; (2) investigation of the utilization of these data in implementing the homemaking program in these three schools; and (3) further testing of the set of instruments in other states and/or schools. 252 pages. $3.25.

AN EVALUATION OF THE COURTIS METHOD IN THE STUDY OF GROWTH RELATIONSHIPS

(L. C. Card No. Mic 58-2372)

Gerald H. Wohlferd, Ph.D.
Michigan State University, 1957

This study was conducted to test the accuracy with which the Courtis method described height and weight growth, to test the use of correlative procedures on derivations of this technique, and to use extrapolation to arrive at new insights into growth.

All cases used in this study were selected from the Dearborn Data which is available at the Michigan State University. All cases selected met the criteria that, measures must be included in a span of from ninety-six months through 180 months, and each pre-adolescent and adolescent

cycle must contain at least three measures of both height and weight. The measures of twenty-six boys and eighteen girls met the above criteria.

Height and weight growth equations were written for each case by use of the Courtis method. Predicted measures were fitted as closely as possible to actual measures.

Cyclic starting and ending times were obtained by substituting the isocronic values for one per cent and 99 per cent respectively, for 'y' in the above equations and solving for 't'. Values attained at one per cent of the adolescent cycle were obtained by substituting age at one per cent for 't' in the pre-adolescent equation and solving for 'y'. Percentages of development were obtained by dividing derived scores by proper maxima.

The Courtis method describes growth in height and weight well within a two per cent average deviation. Height growth was described more accurately than weight growth, The Courtis method describes height and weight growth so accuarately that it may be used to test for growth relationships through various statistical techniques.

Correlations between rates, maxima, ages at one per cent of adolescent growth, 99 per cent of pre-adolescent growth, 99 per cent of adolescent growth, and percentages of development at the beginning of the adolescent cycles were generally positive, but too low for predictive use.

Negative correlations obtained when pre-adolescent height and weight maxima were correlated with respective adolescent height and weight maxima seemed to indicate that large pre-adolescent maxima are followed by smaller adolescent maxima and vice versa.

Correlations derived between values of height and weight attained at one per cent of the adolescent cycle and corresponding total maxima tended to verify the above conclusion.

The use of the Courtis method to find growth relationships through correlative techniques did not produce outstanding results. Correlations obtained between final maxima were no better than those noted in the Review of Literature.

Curves of constants revealed the earlier maturing of girls, while curves of percentages of development disclosed similarities of adolescent starting ages and percentages of total development at the beginning of adolescent growth.

Means of starting time, of pre-adolescent height growth attained when the adolescent cycle began, and of percentages of total growth attained at the beginning of adolescent growth, showed great similarities between height and weight values of each sex. The probability of the existence of equal height and weight adolescent cycle beginning points is evidenced by the small deviations of the above means.

129 pages. $2.00.

THE PRESENT USE AND DISTRIBUTION OF THE CORNELL RURAL SCHOOL LEAFLET

(L. C. Card No. Mic 58-2454)

Dora Eleanor Worbs, Ph.D.
Cornell University, 1958

Chairman: Philip G. Johnson

The Cornell Rural School Leaflet is designed to aid teachers in the elementary grades in the presentation of science material. It is published four times yearly by the New York State College of Agriculture. This publication requires considerable staff time and effort, as well as substantial annual expenditures for printing and distribution. The Cornell Rural School Leaflet has completed its fiftieth volume. Various aspects of the Leaflet service have been studied from time to time, but no detailed study has been made to determine how well the Leaflet serves those for whom it is produced. The present study was undertaken to determine the extent to which it fulfills its purpose.

Purposes. The purposes of this study are to determine the extent and nature of the present use of the Cornell Rural School Leaflet as a basis for formulating wise and practical suggestions for the future. The study seeks information in five major areas:

1) Present and future need for the Leaflet service
2) Standards of eligibility for receiving the Leaflet and the plan for distribution
3) The present extent and nature of the use of the Cornell Rural School Leaflet in the elementary classrooms of New York State
4) Content and format of the Leaflet as related to its usefulness
5) The values to be derived from a continuation of the publication

Scope. The study was limited to the use of the Leaflet in the elementary school programs in New York State.

Methods. Several sources of data were studied. Literature was consulted for the historical survey and for material related to other studies concerning the Cornell Rural School Leaflet. Personal interviews were conducted with 332 teachers of grades K through 6. This material was supplemented by postal card questionnaires to district superintendents, to teachers now receiving the Children's Leaflets, and to a sample of boys and girls whose teachers have ordered Leaflets for them.

Major findings.

1. The purposes and nature of the Cornell Rural School Leaflet have changed with changes in the school curriculum and with the need for the publication. The program originated to encourage the teaching of nature study in the rural schools. When the study of nature became an accepted part of the school program, the Rural School Leaflet was established in 1907 to introduce agricultural subjects. The pattern changed again from the 1920's through the Second World War to stress conservation education. At present an effort is being made to provide readable, accurate science material at the intermediate grade level.

2. Distribution of the Leaflet is a major problem. Nearly 25% of the teachers interviewed had no knowledge of the Leaflet program. Only about one teacher in six had received a Teachers' Leaflet and so had an opportunity to order copies of the Children's Leaflets for her pupils.

3. The title Cornell Rural School Leaflet is confusing and does not give a clear indication of the nature, content, and intended reader-audience of the publication.

4. The content and format of the Leaflet are generally acceptable to teachers. However, it was suggested that color illustrations, larger illustrations, more material suitable for the primary grades, simplified reading, and

periodic indexes, would increase the usefulness of the Leaflet.

5. The Leaflet is used in the classroom primarily as a source of reading and reference material, rather than as a stimulation to investigation, experimentation, and observation.

6. The Leaflet provides helpful science material for teachers who have had an opportunity to use it and these teachers wish to see the publication continued.

Recommendations. The Leaflet program should be continued for the present with the following changes:

1) The title should be changed immediately to some descriptive wording which would give a clear indication of the nature, extent, and purpose of the publication;
2) Efforts should be made to introduce the Leaflet service to teachers and to give them an opportunity to use the service;
3) The teachers' suggestions concerning illustrations, indexes, material for the primary level, and decreased reading diffficulty should be incorporated into forthcoming Leaflets

Further studies. Studies should be made of the place of the Cornell Rural School Leaflet in the junior and senior high school programs and of its use in the Teachers Colleges of New York State. The use of the Leaflet outside of the State should also be investigated. 176 pages. $2.30.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

ENGINEERING, GENERAL

DISCRETE RANDOM FEEDBACK MODELS IN INDUSTRIAL QUALITY CONTROL

(L. C. Card No. Mic 58-508)

Albert Bentley Bishop, III, Ph.D.
The Ohio State University, 1957

A linear difference-equation model is developed for use in the design and analysis of a general class of discrete feedback control systems for random processes, a model which has ready application in industrial quality control. In the way of introduction, the divergence between the vast store of theory available for use in quality control and quality control as actually practiced in industry is pointed out. The industrial process is described, and the necessity for applications of probability and control theories in industrial quality control to handle adequately the inherent non-rigidities of the industrial process is emphasized. Also provided are a brief review of the historical factors leading to the emergence of quality control as an autonomous function in industry and a sketch of the significant developments in quality control since its beginning in 1924. The necessity for simple routinized procedures for successful performance of the quality-control system, whether automatically or manually operated, is emphasized throughout, as are the important economic factors affecting quality control. The decisions necessary to establish and operate a quality-control system are listed, and the notion of a decision rule to handle routine situations is introduced. Criteria by which to evaluate the results of decisions are categorized by the extent to which the designer is able or willing to use his knowledge of the system for evaluation purposes. The concepts of probability, dimensional, and cost risks are included in the discussion of criteria.

A brief review of classical control theory is provided, and a block diagram of the quality-control function is presented in control-theory terms. The effects of random variations in observed values of process mean due to sampling and measurement errors and the action of "assignable" shifts in output are accounted for in the diagram. The forward transfer function consists of an n^{th}-order linear decision rule describing the adjustment to be taken at the time of each observation. The resulting closed-loop system equation is in the form of an n^{th}-order linear difference equation which is solved both by direct methods and by use of the z-transform to relate system performance to the values of the decision-rule parameters. The method of evaluation used is to compute the expression for the mean process output, m_k, after k observations and adjustments have taken place, in terms of the effects of independent assignable shifts and random errors. The expected value and variance of m_k follow by direct methods. The limiting values of the variance of m_k as k is increased without bound are also derived. Stability is determined either from the homogeneous solution of the difference equation or from the roots of the z-transform characteristic equation. The first-order system (the simple proportional controller) and the second-order system (which can be likened to derivative plus proportional control) are treated in detail to illustrate the procedures derived. The z-transform method is found by the use of a simple restriction to permit solution without the necessity of computing initial conditions, a decided advantage in computational procedures. Finally, an adaptation of the Nyquist Stability Criterion is developed by which system stability can be determined without the necessity of finding the roots of determinantal or characteristic equations. Such a method is almost essential when working with high-order complex decision rules. 155 pages. $2.05.

AN INVESTIGATION OF LOW TEMPERATURE INTERNAL FRICTION IN METALS

(L. C. Card No. Mic 58-2434)

Hollis Leland Caswell, Ph.D.
Cornell University, 1958

Equipment and techniques were developed for measuring the internal friction of metal crystals in the 40 kc range over the temperature region from $4^{\circ}K$ to $300^{\circ}K$. For these measurements a modified composite oscillator method, and a specially designed horizontal cryostat were used. The lowest decrement that can be measured is 10^{-8} and changes in decrement of 10^{-7} can be detected. The strain amplitude can be varied from 10^{-9} to 10^{-5} or 10^{-4}, depending on the decrement.

The results on various samples may be divided into three categories; background decrement (the strain amplitude independent decrement), amplitude dependent decrement, and decrement due to the Bordoni relaxation peak and a second, smaller relaxation peak. These results can be summaried as follows:

1) Background Decrement of Copper Samples:

a) In 99.999% pure, annealed, single crystals the background decrement decreases monotonically, but neither linearly or exponentially, with decreasing temperature.

b) A sharper decrease near room temperature is observed in annealed, single crystals which are doped with gold, but is not observed in a crystal doped with nickel. A peak at $180^{\circ}K$ is observed in annealed reeds doped with either gold or nickel.

c) Cold work, in general, increases the background decrement up to a 2% reduction after which it has little effect. The temperature dependence is much less pronounced than in annealed crystals.

2) Amplitude Dependence of the Internal Friction:

a) It is greatest in pure, annealed, single crystals of copper. The breakpoint (i.e. the strain at which the

decrement becomes amplitude dependent) shifts to higher strain amplitudes and becomes sharper as the temperature decreases.

b) The addition of gold to copper reduces the amplitude dependence appreciably. Nickel, produces the same result, but to a much lesser degree than gold.

c) Cold work also systematically reduces the amplitude dependence.

3) The Bordoni Peak:

a) The peak is not present in annealed samples, pure or doped.

b) The peak which occurs at about 80°K in copper is introduced by cold working the sample. Cross rolling has a more pronounced effect on the height of the peak than continued rolling in one dimension in excess of a 3% reduction. Increased cold work shifts the peak temperature to slightly higher values.

c) The peak height can be reduced and even eliminated by suitable heat treatments.

d) The presence of impurities of sufficient concentration decreases the peak height, shifts the peak temperature to slightly lower values, and increases the peak width.

4) A Second Peak in Copper Samples at 40°K:

This peak is much smaller than the Bordoni peak and in the majority of cases is only a "bump" on the low temperature side of the Bordoni peak.

5) Magnesium Samples:

A peak at 20°K was found in cross rolled magnesium, but was not present in semi-annealed stock material. The stock material exhibited extreme amplitude dependence.

6) Crystalline Quartz:

A small peak was found at 39°K which is believed to be caused by the motion of oxygen.

7) Comparison with Theory:

Theories in their present form which attempt to explain the Bordini peak and the amplitude dependence of the internal friction are in qualitative agreement with the experiment, but fail to explain certain details, such as the lack of amplitude dependence and the large width of the Bordoni peak. 135 pages. $2.00.

SOME PROBLEMS IN INVENTORY MANAGEMENT

(L. C. Card No. Mic 58-2476)

Spencer Bailey Smith, Eng.Sc.D.
Columbia University, 1958

The central problem to which the theory of inventory management has been devoted is that of establishing decision rules governing the accumulation of inventory such that some set of cost categories will be minimized. It is the purpose of this study to contribute to the theory of inventory management by providing solutions to a number of hitherto unsolved problems. These problems arose in the course of investigating the inventory policies of a large company engaged in the manufacture of heavy machinery.

The first problem concerns the design of systems for bulk issuance of low-cost parts. Whereas in intermittent manufacture, parts are generally issued from the stockroom to the assembly departments only as authorized by specific production orders, the segregation and issuance in bulk of low-cost parts has been found profitable in many companies. Two decision rules are developed for (1) selecting parts to be issued in bulk and (2) determining the quantities in which they are to be issued, such that the sum of the relevant costs of clerical work, stock selection, handling and carrying inventory will be a minimum.

The second problem deals with the selection of subassembly structures in intermittent manufacture. A common procedure in the manufacture of intricate assembled products is the division of products into various levels of subassemblies which are produced and stocked as separate entities for later use in making higher-level assemblies. The way in which this division is performed has a considerable effect on the amount of clerical work, set-up and handling that is required and the size of the company's investment in inventory. Methods are developed for enumerating and evaluating alternative subassembly structures and selecting those which will minimize the sum of relevant costs.

The third problem is that of projecting a firm's aggregate investment in inventory given a sales forecast, technology of manufacture, inventory policies and a forecast of prices. The method of solution involves the following steps: (1) Divide the inventory into major categories; (2) Estimate the flows among these categories and from purchases and labor and burden using input-output analysis; (3) Estimate the accumulation of inventory in each category from the flows and inventory policies; (4) Divide the inventory categories into production factor components; (5) Apply the forecast price changes to the production factor components of each inventory category; (6) Sum the projections for each inventory category to obtain a projection of the total inventory investment. It is shown how this method of analysis may be useful in connection with a wide range of management problems including financial planning, establishing production, employment and purchasing levels and decisions on changes in manufacturing methods and inventory and make-or-buy policies.

The final part of the study is concerned with decisions on the disposal of slow-moving inventory. The problem may be stated as follows: Given a stockpile of an item and a forecast of use or sale, how many should be scrapped, how many should be reworked into the specifications of another item, and how many should be held for future use or sale? A method of solution is developed using incremental analysis which maximizes the present value of income less expense accruing from the decision. Factors taken into consideration in the solution include marketing and stocking policies, changing cost and price levels, and the corporate income tax.

The majority of the methods presented have been applied extensively in the company in which this investigation was performed, and the results of these applications are reported and evaluated. 143 pages. $2.00.

ENGINEERING, AGRICULTURAL

FACTORS THAT AFFECT DISTRIBUTION OF WATER FROM A MEDIUM PRESSURE ROTARY IRRIGATION SPRINKLER

(L. C. Card No. Mic 58-2414)

Walter K. Bilanski, Ph.D.
Michigan State University, 1956

In 1946 less than 250,000 acres were irrigated by means of sprinkler irrigation; by the latter part of 1954 an estimated 3,000,000 acres were being irrigated by this method and the acreage is increasing at an estimated 500,000 acres per year. Nearly all of the sprinklers installed in the past ten years have utilized the revolving head sprinkler.

Desirable distribution patterns from sprinklers range from a triangular-shaped pattern in which the fall-out is a maximum near the sprinkler and gradually tapers off to zero at the maximum trajectory distance, to a pattern in which the amount of fall-out is uniform along the greater portion of the radius and then decreases gradually for the remainder of the trajectory distance. Because many sprinklers presently in use do not give either of the above distribution patterns of water, and since to date to the author's knowledge no detailed analysis has been made to determine what factors affect the distribution pattern, the objective of this study was to make such an analysis.

This study was conducted indoors to eliminate weather variables. Only medium-pressure sprinklers were studied because this size was the most popular with irrigators and because it lent itself to study in a laboratory. Only one factor from one sprinkler with one nozzle was studied at a time; all other factors were in so far as possible, held constant.

The following factors were investigated and evaluated: oscillating arm, operating pressure, orifice diameter, length of the cylindrical part of the nozzle, angle of taper in the sprinkler nozzle, angle of inclination of the nozzle, rate of rotation of the sprinkler, roughness in the cylindrical part of the nozzle, length of the tube between the body of the sprinkler and the nozzle, non-circular orifices in the sprinkler nozzle, and use of cylindrical discharge tubes in place of nozzles.

It was found that the factors discussed below had the greatest influence in approaching the desired distribution of water. The oscillating arm accentuated the fall-out of water near the sprinkler. A decrease in rate of rotation, an increase in the angle of inclination of the sprinkler nozzle from the horizontal and an increase in the operating pressure all resulted in fall-out of the water approaching the desired distribution pattern. In general, the use of non-circular orifices or of short cylindrical tubes in place of conventional sprinkler nozzles resulted in a more desirable distribution pattern of water. The equilateral-triangular orifices in which the triangular shape extended for a considerable depth into the nozzle resulted in a distribution pattern approaching the ideal. The most desirable pattern was obtained from tube lengths ranging from 2 to 4 diameters.

Turbulence, distribution of velocities and amount of secondary motion affect the dispersion of the jet of water as it emerges from the sprinkler orifice.

133 pages. $2.00.

ENGINEERING, AERONAUTICAL

INTERFEROMETRIC MEASUREMENT OF THE RATE OF DISSOCIATION OF OXYGEN HEATED BY STRONG SHOCK WAVES

(L. C. Card No. Mic 58-2433)

Stanley Richard Byron, Ph.D.
Cornell University, 1958

A long duration spark interferometer and shock tube were constructed with which accurate measurements could be made of the density as a function of time behind shock waves. The properties of the gas can be determined from this measurement and a measurement of the shock speed provided 1) the flow is steady in shock fixed coordinates and 2) a relation between the temperature of the gas and its pressure or enthalpy is available. Chemical kinetic studies can then be made with this instrument.

Measurements of the vibration relaxation time in oxygen and nitrogen were made and agreed with Blackman's measurements. Measurement of vibration relaxation in a 25% oxygen argon mixture indicated that argon is about 1/3 as effective as oxygen in exciting vibration of oxygen.

Dissociation of oxygen was studied in various mixtures of oxygen and argon. Measurements of the initial rate of increase in density were found to be unreliable, but gave a first approximation to the rate of dissociation of oxygen. Measurements of the dissociation time, the time required for the density to reach midway between its no dissociation value and its equilibrium value, were also made. The dissociation time was related to the dissociation rate by numerical integration. The form of the dissociation rate was based on collision theory. The temperature dependence as well as values of the transition probabilities were determined from data taken over the temperature range 2500°K to 5000°K. It was found that atomic oxygen is very effective in causing dissociation of oxygen.

By comparing the measured vibration relaxation times with the measured dissociation times in oxygen it was shown that they will be ordered first and second respectively over the range of temperature and density of interest to aerodynamicists.

Studies of nitrogen vibration and oxygen dissociation in air were also made. The time required for relaxation of nitrogen vibration was found to be about a factor of 4 shorter than the time required for dissociation of oxygen at the temperature and density at which measurements were made. The effect of nitrogen on dissociation of oxygen was noticeable but not very large. It could not be determined more accurately because the relaxation rate of nitrogen vibration and the dissociation rate of oxygen are interrelated through the temperature of the gas.

107 pages. $2.00.

ENGINEERING, CHEMICAL

A STUDY OF INTERPHASE MASS TRANSFER IN A POROUS MEDIUM

(L. C. Card No. Mic 58-2272)

Ralph Edward Gilchrist, Ph.D.
The Pennsylvania State University, 1958

When a hydrocarbon gas, or another gas appreciably soluble in a liquid hydrocarbon is displaced by another in a porous medium containing a liquid hydrocarbon at a saturation below that required for mobility, there will be three zones. The first, or leading zone, contains the gas which is in equilibrium with the oil, in accordance with the solubility of the various components. The third, or trailing zone, contains gas of the composition injected, the oil having been changed in composition so as to be in equilibrium with this injected gas. Between these two zones, there is a transition zone in which the composition varies continuously from that in the leading zone to that in the trailing zone.

Previous theoretical analyses have attributed the extent and composition gradients of the transition zone chiefly to the time required for establishment of new vapor-liquid equilibrium conditions. The role of "axial mixing", or relative movement of components in the direction of flow within the moving gas phase, have been ignored.

In order to study the relative importance of this "axial mixing" process, as compared to a lag in establishment of equilibrium, in forming the transition zone, a series of gas displacement experiments were made using a natural sandstone core about three feet long. The core was loaded so as to contain a gas at a certain pressure in equilibrium with hexadecane, which was at a saturation below that required for mobility. This gas was then displaced by another gas at the same pressure, except for the pressure drop (not more than 10% of the absolute pressure) necessary for flow. The composition of the efflux gas was determined during the displacement, giving the extent and composition gradients of the transition zone. Runs were made with methane displacing carbon dioxide, nitrogen displacing methane, and a nitrogen-methane mixture (80:20) displacing a nitrogen-carbon dioxide mixture (80:20), at various pressures, ranging from near atmospheric to 100 psig, and at various velocities. Similar displacement runs were made with the core containing no liquid.

The results were analyzed by the use of equations developed on the assumption that the transition zone was caused primarily by "axial mixing", that is, transfer of components in the direction of flow, within the moving gas phase. Following are the general observations and conclusions:

(1) The extent of the transition zone was increased by about 50% by the presence of oil, other factors being held constant.

(2) Pressure had no apparent effect on the extent of the transition zone, in the range studied.

(3) With oil present, the extent of the transition zone was slightly higher when carbon dioxide (which is more soluble than methane) was displaced, than when methane was displaced.

(4) Mathematically, the transition zone can be accounted for just as well on the basis of an "axial mixing" process, with no lag in vapor-liquid equilibrium, as on the basis of such a lag.

(5) The present study does not prove that a lag in the establishment of equilibrium is not a factor in determining the nature of the transition zone, although the data can be accounted for theoretically without considering the lag as a major factor.

88 pages. $2.00.

USE OF FLOW PATTERNS IN PREDICTING SHELL-SIDE HEAT TRANSFER COEFFICIENTS FOR BAFFLED SHELL-AND-TUBE HEAT EXCHANGERS

(L. C. Card No. Mic 58-924)

Rajeshwar Kumar Gupta, Ph.D.
University of Michigan, 1957

The purpose of this investigation is to gain an insight into the mechanism of heat transfer on the shell side of baffled shell-and-tube heat exchangers and to establish the significance of the shell-side fluid flow patterns in determining the shell-side heat transfer coefficients. A simultaneous study of the flow patterns, heat transfer characteristics, and pressure drops on the shell side of a segmentally baffled shell-and-tube heat exchanger, with the shell and the tubes made of Pyrex brand glass, was conducted.

Data are reported on shell-side flow patterns, heat transfer characteristics, and pressure drops for six tube bundles with the same tube size and arrangement but with different combinations of baffle cuts and baffle spacings. Though the study is restricted to baffles of the segmental type, it is felt that the ideas presented here can be extended to other baffle types. The baffles for the test bundles were specially designed to eliminate the tube-to-baffle and the baffle-to-shell leakage. The tube arrangement was such that very little empty space was left around the peripheral tubes, thus appreciably reducing the bundle by-pass.

A propylene glycol-water solution was used as the hot fluid on the shell side and the tube side was cooled with water. Only the effect of the variation of the shell-side flow rate was studied for the six bundles.

The flow pattern studies reveal that the flow on the shell-side may be divided into zones of three different flow characteristics, namely:

1) The "longitudinal flow" zones,
2) The "true cross flow" zones,
3) The "eddy" or "dead" zones.

In the conventional concept of the shell-side flow, only longitudinal and cross flow regimes are recognized. According to current practice, the shell-side heat transfer film coefficients are calculated by a single empirical correlation using some kind of an average velocity for the longitudinal and the cross flow zones. The correlations available for this purpose do not take the eddy zones into account, and the sum of the regions found in the present study to be in cross flow and those in the eddy zones are considered as cross flow regions. This is equivalent of assuming the mechanism of heat transfer in the eddy zones

to be the same as that in cross flow. The present study shows that this inherent assumption in the correlations available in the literature is not valid. The mechanisms of fluid flow and heat transfer in the eddy zones are shown to be considerably different from those in cross flow, thus necessitating the treatment of the eddy zones separately from the other characteristic zones in calculating the shell-side film coefficients.

Using the correlations available in the literature for predicting the film coefficients for flow of fluids outside and parallel to tube bundles and those for flow of fluids across tube bundles, a correlation for the eddy zone heat transfer film coefficients is obtained from a knowledge of experimental total shell-side film coefficients and of the shell-side flow patterns. By using this correlation for predicting the eddy zone coefficients and the correlations from the literature for the other two types of zones, the film coefficients for the three types of zones can be calculated. The total shell-side film coefficients can then be obtained by a weighted (on heat transfer area) summation of the three component film coefficients. Within the range of the present study the film coefficients predicted by the proposed method lie within ± 10 percent of the experimental values.

The pressure drop data obtained in the present study are also correlated. The pressure drop correlation is between the overall shell-side friction factor (defined as

$$f_o = \frac{\Delta P g_c \rho X}{2 L G_w^2}$$

and the baffle-window Reynolds number). All the pressure drop data for the six bundles tested fit the proposed correlation with deviations less than ±10 percent.

147 pages. $2.00.

ULTRAFILTRATION OF NON-ELECTROLYTES THROUGH CELLOPHANE

(L. C. Card No. Mic 58-1412)

William Ernest Henderson, Ph.D.
University of Michigan, 1957

The purpose of this investigation was to determine the factors which control the retention of non-electrolytes by ultrafiltration membranes having heterogeneous pore structures.

Equipment was designed and constructed for a steady-state process in which pressurized aqueous solutions of dextrose, sucrose, and raffinose were recirculated past supported membranes of regenerated cellulose.

Solute concentration in the ultrafiltrate was related to solute concentration in the recycle liquid, temperature, ultrafiltration rate, recirculation rate, and solute molecular weight, in a study of the three binary aqueous solutions. The cellophane membranes used were all substantially identical. The ranges for each variable were as follows: concentration, 0-25 weight per cent; temperature, 25-50°C.; ultrafiltration rate, 0.05-0.86 cc./hr.-sq.cm. (or pressure differences of 50-930 lb. per sq. in.); recirculation rates, expressed as Reynolds numbers, 182-23,900; and solute molecular weight, 180-504. Solute retention was increased by increased ultrafiltration rate, by increased turbulence in the pressurized solution, and by increased molecular weight. Higher temperatures decreased retention at a given ultrafiltration rate, but this effect was compensated at a given pressure difference by the increase in ultrafiltration rate. Higher concentrations resulted in somewhat greater percentage retention, particularly at high ultrafiltration rates. A brief study of the ternary system water-sucrose-raffinose indicated that each solute was retained to about the extent predicted on the basis of the data for binary systems. Therefore, separation of nonelectrolyte molecules in solution by ultrafiltration on the basis of molecular size is possible.

Several mechanisms are suggested for the observed effects. These mechanisms are tested by correlating the experimental data. A combination of the effect of recirculation rate with an appropriate mechanism led to a unique method for determining mass transfer coefficients for liquid films by (in effect) actually sampling a solid-liquid interface. 221 pages. $2.90.

A STUDY OF FACTORS AFFECTING EFFICIENCIES IN 2, 4, 6, AND 12-INCH DIAMETER DISTILLATION COLUMNS

(L. C. Card No. Mic 58-2273)

Wilfried D. Hirsch, Ph.D.
The Pennsylvania State University, 1958

This investigation is concerned with the study of 2, 4, 5.75, 6, and 12-inch diameter distillation columns with the main emphasis given to the development of an interdistributor that would prevent loss of efficiency when column diameter and height are increased. Twenty designs were studied and a good design was achieved with an interdistributor consisting of truncated cones beneath corresponding holes in a screen disk, with a plain screen disk below the cones to complete the assembly.

The test mixtures employed were the systems n-heptane - methylcyclohexane and benzene - toluene at atmospheric pressure, and n-decane - transdecalin for vacuum operation.

The more important results obtained from this investigation are listed below.

1) Of all interdistributors tested in a 5.75-inch diameter column, a truncated cone type interdistributor was best. Excellent H.E.T.P.'s were obtained with this interdistributor; at a vapor velocity of 1.4 ft/sec the H.E.T.P.'s for the 6, 12, and 17-foot packed heights were 2.35, 2.25, and 2.42 inches respectively.

2) A 12-inch diameter column can be made very efficient with an annular design and the elimination of a liquid distributor plate at the top by using a properly designed condenser to serve this purpose. The results with this type of column were excellent. At 80% of flood rate the H.E.T.P. was 1.0 to 1.2 inches and 1.1 to 2.4 inches at 30 and 76 mm Hg condenser pressures respectively.

3) Good H.E.T.P.'s in a 6-inch diameter column (1.9 to 3.6 inches) can be obtained if no top liquid distributor is employed but all reflux is directed into the center of the top of the packing provided an interdistributor

is used 1 foot from the top of the packed bed and every 3 feet thereafter.

4) Of the several startup techniques tried, the Total Preflood method is the most reliable, both from the standpoint of higher column efficiency and because of reproducible startup conditions; however, the variations are not large.

5) H.E.T.P.'s with no preflood are from 9 to 44% higher than with Total Preflood; however, with and without preflood, the H.E.T.P.'s are low (1.6 to 3.3 inches).

6) Wall-liquid collectors for a 5.75-inch by 6-foot column are beneficial if the top liquid distribution is bad, but of no advantage if the initial distribution is good.

7) Controlled cycling increased the capacity by 31% for an 83-perforated-plate 2-inch by 7-foot column, but had no effect for the same tube packed with 0.24-inch Protruded Stainless Steel.

8) H.E.T.P. data obtained in this investigation in a 4-inch by 10-foot column filled with 0.24-inch Protruded Packing were from 6 to 28% lower than those obtained by previous investigators. These new results are now more in line with existing data for 2, 3, and 6-inch columns of similar length. The difference between the author's and previous data is probably due to a difference in packings. The author used Protruded Packing of later design with a larger hole size (called size B).

9) Operating a cold finger condenser extending through the length of a 6-foot packed bed of a 5.75-inch diameter column has little effect upon the H.E.T.P. when as much as 34% of the total vapor is condensed this way. It is interesting that with this type of operation various boilup rates can be obtained with the same pressure drop.

10) Vertical alignment was found to be important in the case of the 5.75-inch by 6-foot column. An increase of 41% in H.E.T.P. was observed when the column was tilted 1.5 centimeters in 6 feet.

196 pages. $2.55.

MECHANISMS OF FLUID-PHASE MIXING IN FIXED AND FLUIDIZED BEDS OF UNIFORMLY SIZED SPHERICAL PARTICLES

(L. C. Card No. Mic 58-2123)

George Andrew Latinen, Ph.D.
Princeton University, 1954

The studies contained in this thesis represent another step in the quantitative approach to fixed and fluidized-bed reactor design. The specific subject matter of the thesis is concerned with the mechanisms of fluid-phase mass transfer in fixed and liquid-fluidized beds.

The work is divided into two main sections. In Chapter I, liquid-phase diffusivities normal to the direction of flow were measured in beds of compacted spheres contained in a 2" tube. The diffusivities were calculated from the measured rate of spread of a dye tracer solution which was injected coaxially into the bed at a point source. Correlating variables were modified Peclet number, D_pU/E, and modified Reynolds number, D_pG_o/μ. The data cover a range of particle-to-tube ratio from 0.018 to 0.20, bed height-to-particle diameter ratio from 180 to 6.1, and modified Reynolds number from 6.3 to 3900.

Emphasis was placed on a study of the mechanisms of intersticial mixing in packed beds. A 2-dimensional flow analogue provided the basic ideas regarding the nature of the intersticial flow. These ideas were incorporated in an appropriate statistical treatment which was consistent with the experimental results. A theoretical interpretation of present data as well as data of Bernard and Wilhelm (1) is provided, based on the mechanism model.

In Chapter II, the nature of fluid-phase turbulence in liquid-fluidized beds was studied, using the above-mentioned dye tracer method. The first part of the chapter presents results of diffusion measurements for beds of high uniformity. Experiments were performed in a 2" glass pipe. The range of fraction void was from about 0.45 to 0.96 for each of the following particles: 1/2, 1, 2mm. spheres. The latter part of the chapter describes a direct application of diffusion measurements for estimating the intensity and scale of the liquid turbulence, based on G.I. Taylor's statistical theory of turbulence. The necessary measurements were made for two fluidized beds of high and intermediate uniformity, respectively, and the turbulence parameters were determined for the latter. The data were in excellent agreement with the statistical theory as applied to the simplest cast of uniformly distributed isotropic turbulence. 114 pages. $2.00.

REACTIVITY OF COMPRESSED CEYLON NATURAL GRAPHITE TO CARBON DIOXIDE

(L. C. Card No. Mic 58-2274)

Frank Rusinko, Jr., Ph.D.
The Pennsylvania State University, 1958

The reaction of molded Ceylon natural graphite with carbon dioxide has been used in this investigation. The carbon-carbon dioxide reaction has been studied since it is one of the simplest heterogeneous reactions of carbon, carbon monoxide being the only reaction product formed.

Samples one inch in length and 1/2 inch in diameter were molded from 2 micron natural graphite to apparent densities ranging from 1.6 to 2.0 g./cc. Samples of 2600°C heat treated graphite (impurity content nil as compared to 2.10 per cent for original graphite) could not be produced by molding, indicating that the heat treatment had in some way affected the molding characteristics of the graphite. To overcome this problem, samples were first molded and then heat treated.

Solid-phase bonding of carbon has been postulated to be dependent upon the presence of carbon-oxygen complexes on the surface, adsorption of condensible vapors on these sites, and an inherent flake-like crystallographic structure similar to that of natural graphite. Water vapor adsorption data indicate that the original graphite has 13.2 per cent hydrophilic sites, while the heat treated graphite has only 0.60 per cent.

Reactivity of the compressed samples to carbon dioxide

was investigated in the temperature range 800°C. to 1100°C. Heat treatment of the graphite lowered the reactivity by a factor of 10, presumably a result of purification. An activation energy of 42 + 2 kcal./mole for both the original and heat treated graphite was calculated, indicating the rate of reaction was controlled by internal pore diffusion.

From the Arrhenius equation, the frequency factor for the heat treated graphite is 1.69×10^4 and for the original graphite 1.51×10^5, while it is calculated to be 2.85×10^8 from simple kinetic theory of gases. The fact that the frequency factors calculated from the Arrhenius equation are less than that calculated from kinetic theory indicates that only a small fraction of the natural graphite surface is active to carbon dioxide. The fact that the heat treated graphite had a ten-fold smaller frequency factor than the original graphite indicates that the removal of impurities decreased the fraction of the total surface area active to carbon dioxide by ten.

No appreciable difference in specific surface area was found between the powdered graphite and the molded graphite, indicating that essentially the same area is available to the adsorbing gas for both types of samples. The powdered graphite area is 11.6 $m.^2/g.$ while the areas of samples compressed to apparent densities of 1.3 and 2.0 g./cc. are 11.1 $m.^2/g.$ and 11.3 $m.^2/g.$, respectively.

An increase in specific surface area of the graphites was found as reaction temperature was increased. In an attempt to explain this area increase, areas have been calculated assuming either uniform or non-uniform reaction over different particle shapes. In one case, 0.2 micron diameter spheres (surface area = 13.3 $m.^2/g.$) are taken as a model and in the other case cylinders 4 microns in diameter and 0.07 microns in height (surface area = 13.1 $m.^2/g.$) are taken. The area development is calculated for 10 per cent burn-off, assuming various percentages of graphite in the sample to be gasified uniformly, the remainder being unchanged. For the spherical model, reaction is assumed to take place entirely to decrease the diameter, while for the cylindrical model, reaction is assumed to take place entirely either to decrease the height or to decrease the diameter. For the cases considered, the total suface area of the samples was not significantly changed. The magnitude of the surface area increases found experimentally cannot be explained by simply a decrease in particle size or a change in percentage of the starting sample weight which underwent reaction. Apparently a major part of the increase in specific area with reaction is caused by increasing surface roughness or opening up pore area within the graphite particles. 101 pages. $2.00.

A STUDY OF PERFORATED PLATE AND PACKED LIQUID-LIQUID EXTRACTORS USING CONTROLLED CYCLING

(L. C. Card No. Mic 58-2275)

Ted Tibor Szabo, Ph.D.
The Pennsylvania State University, 1958

The principle of controlled cycling was applied to the operation of perforated plate and packed extraction columns.

The controlled cycle of operation consisted of four individually timed periods which are described below.

1. Light Phase Input Period. During this period, the light phase feed was introduced into the bottom of the column and the light phase product was removed at the top.

2. Delay Period. During this period, the droplets formed during the light phase input period were coalescing. There was no liquid flow during this period.

3. Heavy Phase Input Period. During this period, the heavy phase feed was introduced into the column at the top, and the heavy phase product was removed at the bottom of the column.

4. Delay Period. During this period, the droplets formed during the heavy phase input period were coalescing. There was no liquid flow during this period.

An important feature of the extractors that are based on the principle of controlled cycling is that the droplets of the discontinuous phase are given high velocities in the direction desired. The flow capacity of the column is not limited by the density difference of the phases.

The investigation included the study of such factors as plate spacing, column height and hole diameter in the case of perforated plate columns, and column height, packing size and end-plate effects in the case of packed columns.

A total of 13 different types of 2-inch I.D. columns was tested. The test system employed was the methyl isobutyl ketone - acetic acid-water system. The light phase feed was methyl isobutyl ketone containing 12 to 15 percent acetic acid by weight and saturated with water. Water was used as a solvent.

The important conclusions are summarized below.

1. All efficiency tests were correlated by plotting the efficiency of the column (H.E.T.S. or Number of Theoretical Stages) against the volumetric flow rate ratio of the ketone product to aqueous product.

2. When the column height was increased from 58 inches to 119 inches at a plate spacing of 8.3 inches by increasing the number of perforated plates from 8 to 15, the overall stage efficiency decreased from 64 percent to 57 percent (at a volumetric flow rate ratio of 1.04). Similar tendency was observed at a plate spacing of 3.9 inches. When the height of the column was increased from 39 inches to 58 inches (8 to 15 plates spaced 3.9 inches apart), the overall stage efficiency decreased from 61 percent to 41 percent (at a volumetric flow rate ratio of one).

3. In contrast with the perforated plate extractors, when the heights of the packed columns were doubled the number of theoretical stages were also doubled.

4. The lowest H.E.T.S. obtained was 4.6 inches for the column with 58-inch section of 0.16-inch protruded packing. In general, the 0.16-inch packing gave higher efficiencies than the 0.24-inch packing.

5. The packed columns increased their efficiencies with a decrease in ketone input periods.

6. When the plate spacing was increased from 3.9 inches to 8.5 inches, keeping the free area for flow constant (5.3 percent), the maximum flow capacity of the perforated plate column increased from 1620 gal./hr.ft.^{2} to 2330 gal./hr.ft.^{2}.

7. When the size of the protruded packing in the column was increased from 0.16 inches to 0.24 inches, the maximum flow capacity increased from 530 gal./hr.ft.^{2} to 860 gal./hr.ft.^{2}. 144 pages. $2.00.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

ENGINEERING, CIVIL

SOME BASIC ASPECTS OF THE PROBLEM OF SHEAR STRENGTH OF REINFORCED CONCRETE BEAMS

(L. C. Card No. Mic 58-2444)

Sidney Aaron Guralnick, Ph.D.
Cornell University, 1958

The behaviour of plain concrete subjected to a plant state of stress consisting of shearing and compressive stress components has been investigated. It has been found by comparison with numerous test results that Mohr's rupture theory is adequate in predicting failure stresses for such cases. Equations based on Mohr's theory have been developed which express the "interaction" of the shearing and compressive stresses at failure. The problem of predicting the ultimate load of beams failing in shear has been approached by applying the "interaction" equations developed for plain concrete, since it has been recognized that failure in shear is essentially a failure of the concrete. A failure theory for the cases of beams with plain webs and beams with vertical stirrups has been developed. Test data from forty-five beams have been used to check the validity of the theory developed.

128 pages. $2.00.

A STUDY OF NON-UNIFORM FLAT PLATES SUPPORTED ON NON-EQUIDISTANT VERTICAL SUPPORTS

(L. C. Card No. Mic 58-2161)

Louis Albert Scipio II, Ph.D.
University of Minnesota, 1958

Statement of the Problem

The bending of plates supported on rows of equidistant vertical supports has been discussed by several investigators; see for example, Nadai, "Elastische Platten". In this simplified case, if the lateral load is uniformily distributed, the bending in all panels except those near the boundary can be assumed to be identical.

This investigation treats the general case, that is, if the rows of vertical supports are not equidistant, including the effect of non-uniform plate thickness.

The mathematical treatment of the problem is based upon the calculus of finite differences as applied to plate theory.

Method of Approach

General Assumptions

In general, it is assumed that the fundamental differential equations and boundary conditions derived for plates of constant thickness apply with engineering accuracy, provided they are modified to take into account thickness variations. Further, it is assumed that the dimensions of the vertical supports are small and do not affect the moments and shears at an appreciable distance from the supports. Also, the deflections at the supports are assumed to be zero.

Approach

To simplify the mathematical analysis, the plate is divided at the supports into a number of panels with free edges and supported at the corners. When the panels are rejoined, continuity at common points of adjacent panels must be satisfied. Adjustments in the deflections and slopes to assure these equalities are made by introducing appropriate moments and shears at the common boundaries.

The solution of the given problem is obtained by superposing the individual panel analysis, considering first the lateral load with the solution with the continuity moments and shears applied (no lateral load).

The theory was checked by a series of lateral load tests on plate models.

114 pages. $2.00.

ENGINEERING, ELECTRICAL

ELECTROLYSIS AND THE ACTIVATION PROCESSES IN THE OXIDE COATED CATHODE

(L. C. Card No. Mic 58-2145)

Donald Edward Anderson, Ph.D.
University of Minnesota, 1958

Adviser: W. G. Shepherd

This thesis presents a study of the influence of an electric field in producing both transient and permanent changes in the activity of oxide coated cathodes. This involves a study, in special tube structures designed to minimize competing processes, of (a) the thermionic emission of the cathode, (b) the conductivity of the cathode coating, and (c) the evolution of strontium from the coating, using radioisotope techniques.

Apparatus has been developed which permits a determination of the true saturation emission of an oxide cathode by making possible a correction for the resistive voltage drop in the coating. The apparatus permits consistent and reproducible determinations of both the saturation emission and the coating conductivity in standard diode structures operated under low duty cycle pulsed conditions, with minimum disturbance of the state of dynamic equilibrium of the cathode during the measurement.

It has been demonstrated that the passage of continuous current results in a true enhancement of cathode activity. The enhancement in activity is a monotonically increasing function of the current density through the coating. It has been found that, when a continuous current is drawn through the cathode, the saturation emission of the cathode approaches a higher stable level by a mechanism characterized by a time constant of the order of ten minutes. If current drain is discontinued, the saturation emission of the cathode decreases but to a level above the initial value. A true enhancement of the emission occurs which can be further developed by additional continuous current drain. The final value to which the emission falls on cessation of current drain is a function of the total time that current has been drawn; maximum enhancement is approached following continuous current drain for at least 15 hours at 1119°K.

These results have been interpreted in terms of a model

in which the donor concentration at the emitting surface of each particle of the oxide coating is increased by the passage of current through the surface. The model predicts that the surface concentration of donors should increase in exponential fashion to a final value which is proportional to the cube root of the current drain, and that the time constant for this "surface activation" should be of the order of 10 minutes. The permanent enhancement in donor concentration is viewed as being the result of the diffusion of donors into the interior of the particles, this process requiring some tens of hours to approach completion. The available data are in reasonable agreement with the predictions of this model.

The results of these studies indicate two basic features of the operation of oxide coated cathodes which must be correlated with other studies of the processes of chemical activation and cathode poisoning. First, the development of a permanent enhancement of cathode activity, which persists even after current drain is removed, suggests that the donors are stable in the absence of processes leading to donor destruction. Second, the results indicate that the emission of an oxide cathode is governed by the donor concentration in a thin "skin" at the surface of the oxide particles. The implications of these facts on previous analyses of the process of chemical activation are discussed, and a model in which bulk properties are invoked in determining the surface donor concentration in activating a cathode chemically is proposed. This model is in qualitative agreement with available data, although further studies on the details of chemical activation are needed to shed light on the activation process and on the "irreversibility" of donor production. 172 pages. $2.25.

A THEORETICAL STUDY OF LINEAR DYNAMIC SYSTEMS WITH PERIODIC, PIECEWISE CONSTANT PARAMETERS

(L. C. Card No. Mic 58-2010)

Edward Otis Gilbert, Ph.D.
University of Michigan, 1957

The purpose of this study is to develop techniques for determining the response and response characteristics of linear time-variant systems characterized by periodic, piecewise constant parameters. Emphasized are methods that have the significant advantage of being directly analogous to the familiar operational methods employed in the study of linear time-invariant systems. The resultant theory is useful in the analysis of many physical systems including electrical networks with periodic switching, certain time-variant control systems, and time division multiplex systems.

Study of response presupposes a mathematical formulation. The considered systems are described in every fundamental period in a sequence of time intervals by a corresponding sequence of linear vector differential equations with constant matrix coefficients. Initial condition matrices determine the initial condition on each interval from the end condition of the previous interval. The vector formulation is used to minimize notation and manipulation difficulties and to make results independent of system order. Appendices I and II introduce the vector notation and present the operational methods of the time-variant transfer function and the time-variant impulse response in vector form.

Analysis results in explicit relations for the piecewise solution, the time-variant transfer function, the output spectrum, and the time-variant impulse response. These results provide a variety of solutions to the response problem. The piecewise solution in conjunction with iteration formulas determines the solution from interval to interval. Fourier and Laplace transform procedures involving the time-variant transfer function offer another solution. Simplifying approximations, which are frequently justified, usually are required. The time-variant transfer function is particularly useful in that it gives directly an exact solution for the important exponential input. An expression is also given for determining the output spectrum for a given input spectrum. The time-variant impulse response permits a direct solution to the homogeneous problem and through the superposition integral gives the response for an arbitrary input. Although these methods offer a straightforward approach for determining response, computation is frequently excessive.

Simplified methods are presented for determining system stability and response characteristics. The methods are based on characteristic roots given by the zeros of a polynomial in $z = e^s$. The polynomial is of the same degree as the system order and is determined with relative ease. The stability of the system response is assured if the s values of the characteristic roots lie in the left half of the s plane. Stability can be obtained directly without determining the s values by examination of the polynomial in z. The response characteristics of the system are determined to a great extent by the location of the roots in the s plane. A graphical method is presented for determining these locations from the polynomial in z. The technique is valuable in the synthesis of second order systems for desired response characteristics. Several examples are considered. 116 pages. $2.00.

THE UNDERWATER SPARK: AN EXAMPLE OF GASEOUS CONDUCTION AT ABOUT 10,000 ATMOSPHERES

(L. C. Card No. Mic 58-1433)

Edward Anthony Martin, Ph.D.
University of Michigan, 1957

The underwater spark is treated as a problem in gaseous electrical conduction at pressures of the order of 10,000 atmospheres. Four basic spark parameters are determined as functions of time: the channel size, the energy input, the pressure, and the temperature. These four quantities permit carrying out a particle balance and an energy balance as functions of time. The mutually consistent results provide an extension of the theory of gaseous conduction into the domain of extremely high pressures.

The four basic quantities were obtained as follows: The channel size was scaled from quarter-microsecond Kerr cell photographs of the spark. The spark energy input was obtained by a circuit energy balance in terms of spark current and discharge circuit parameters. The

channel pressure was calculated from the rate of channel expansion and the hydrodynamic characteristics of water. The channel temperature was obtained from absolute measurements of radiation by means of phototubes. These four quantities provide information from which the energy stored in the spark channel may be calculated by two independent procedures. First, the significant energy losses from the channel may be subtracted from the measured energy input. The mechanical work to generate the shock wave in the water was found to be the greatest energy loss. Radiation was found to be a smaller, but appreciable, loss. Thermal conduction was found to be negligible. Second, the spark-channel energy may be obtained from the solution of a simultaneous set of particle-balance equations. These equations, including Saha thermal-ionization equations and Boltzmann's relations, yield the amount of dissociation, excitation, and ionization in the channel. The channel energy computed by these two methods is given as a function of time.

The following conclusions were reached concerning the underwater spark as produced by the discharge of a 5.8-microfared capacitor charged to 25 kilovolts. The peak current is 85,000 amperes. At the moment of peak current the channel external pressure, including average pinch pressure, is 8330 atmospheres. The channel is in thermal equilibrium and radiates diffusely a continuum corresponding to a blackbody at about 29,900°K. The total particle density in the channel is approximately 2×10^{27} per cubic meter. The particles consist primarily of dissociated oxygen and hydrogen; and the degree of ionization is 30 percent. The major portion of the spark input energy is initially stored within the channel in the form of kinetic energy and energy of dissociation, excitation, and ionization. This energy is then relatively slowly dissipated in the form of mechanical work to the shock wave and in thermal radiation. There is evidence that the spark plasma has an internal pressure due to Coulomb interparticle forces; an approximate calculation of this pressure is carried out. Channel magnification caused by refraction in the compressed shock wave is found to be appreciable.

The Kerr cell photographs reveal the formation of spherical structures on the spark electrodes under certain conditions. These have not been previously reported. A short discussion of them is included. Their presence is ascribed to the highly polar nature of the water molecule.

The experimental value of plasma electrical conductivity is compared to values calculated from the work of Gvosdover and of Spitzer and Harm for completely ionized gases. The agreement is excellent. The theory of Spitzer and Harm is also applied to thermal conductivity in the plasma. It is concluded that wall recombination is more than ample to supply the required energy to vaporize water at the spark-channel wall. Various applications of the underwater spark are discussed, such as its use as a light source, as a sonic source, or for punching metal. Finally a discussion and derivation of the Saha thermal-ionization equation are included. 201 pages. $2.65.

ENGINEERING, MECHANICAL

A METHOD FOR THE PREDICTION OF THE OFF-DESIGN PERFORMANCE OF AXIAL-FLOW COMPRESSORS

(L. C. Card No. Mic 58-2201)

George Kaspar Serovy, Ph.D.
Iowa State College, 1958

Supervisors: Dr. Herbert J. Gilkey and
Dr. Henry M. Black

A method is developed for the prediction of the off-design performance of axial-flow compressors. This method is made consistent with a framework of equations and blade-element performance correlations commonly used in compressor design, and represents an attempt to provide a more general off-design performance prediction procedure than "stage-stacking" techniques which use assumed stage performance data.

The procedure assumes that for a specific blade row, the entrance flow conditions are given or known from the application of the method to the preceding blade row. These flow conditions, or in the case of a rotor-blade row the calculation of relative air inlet conditions, make possible the estimation of blade-element performance for known blade-row geometry. Blade-row outlet flow conditions are calculated by first approximating the outlet flow conditions using the isentropic-simple-radial-equilibrium equation and the continuity equation. Next improved outlet flow distributions are computed by using the non-isentropic-radial-equilibrium equation and the continuity equation. Losses for each of the non-isentropic approximations are estimated on the basis of the preceding approximation to the flow distribution.

In applying the method in this study the complicated iterative solutions for blade-row outlet conditions were performed using an IBM 650 digital computing machine. Blade-element performance correlations at off-design conditions were made for 65-(A_{10}) series blade sections.

The performance of a rotating blade row was predicted using the proposed method. For comparison purposes, experimental performance characteristics of this blade row were available from a previous investigation. At rotor-tip speeds which resulted in low relative inlet Mach numbers, computed performance was in good agreement with that determined experimentally. For higher speeds where the basic cascade data is not so applicable a narrower satisfactory operating range was predicted than had been obtained experimentally. However, the general trend of the results was correct, and with improvement of the estimation of high Mach number effects on blade-element performance, it is believed that the discrepancies can be reduced. 77 pages. $2.00.

ATTENUATION OF LARGE AMPLITUDE PRESSURE PULSATIONS IN SUCTION LINES OF RECIPROCATING AIR COMPRESSORS

(L. C. Card No. Mic 58-1001)

James Franklin Sutton, Ph.D.
University of Michigan, 1957

The study was performed to determine the magnitude of attenuation factors for pressure variations in the pulsating air flow of the intake piping systems of air compressors and internal combustion engines. The variation in the velocity in the piping due to the valve action causes a standing wave in the piping. This standing wave can be used to supercharge the cylinder if the length of the pipe is adjusted so that resonance is produced. Prediction of excess pressure amplitude above ambient and the phase difference between pressure and velocity depends upon accurate determination of the attenuation in the piping system. Basic data for the variation of attenuation factors with excess pressure amplitude, frequency, and pipe diameter are presented.

Theoretical relationships for the transmission of pressure waves through the intake piping system and their reflection at the open end are derived for simple sound theory and for modified sound theory including attenuation.

The Helmholtz - Kirchoff theory is reviewed for the effects of viscosity and thermal conduction on attenuation. Specific impedance is defined and derived for the case of one dimensional pipe flow.

An experimental investigation of the amplitude of attenuation was made by measuring excess pressure amplitudes above ambient with a catenary diaphragm strain gage transducer and velocity changes by means of a hot-wire anemometer. Excess pressure amplitudes ranged from 0.75 psi to 4.5 psi and frequency ranged from 5 cycles per second to 25 cycles per second. Both two and four inch nominal pipe diameters were used in the experimental program.

Experimental results were correlated by use of a parameter of the attenuation factor times the diameter of the intake pipe divided by the square root of the frequency. This parameter decreases for higher amplitude excess pressures and agrees well with previous values reported by Boden. The amplitudes of this parameter decreased from 0.0015 for an excess pressure of 0.75 pounds per square inch to 0.0005 for an excess pressure of 4.0.

Pressure amplitudes in suction piping can be predicted for cases where the velocity variation with time is known. A solution to a typical design problem for a four stroke cycle single engine suction pipe is outlined.

84 pages. $2.00.

ENGINEERING, METALLURGY

GRAIN BOUNDARY SLIDING IN COPPER BI-CRYSTALS

(L. C. Card No. Mic 58-2465)

Josef Intrater, Eng.Sc.D.
Columbia University, 1958

The phenomenon of grain boundary sliding (motion of grains along a common boundary) was studied in bi-crystals of copper which were oriented to minimize slip in the adjoining grains. It was found that sliding occurred within a very narrow zone. Prior plastic deformation is not necessary to achieve boundary sliding; however, when specimens were plastically deformed prior to grain boundary sliding, a decrease in the flow resistance of the region adjoining the grain boundary to shear stress parallel to the boundary was observed. Sliding is spasmodic with no incubation time and occurs with an activation energy of 40,000 cal/mole when tested in a vacuum of 5×10^{-4} mm Hg and 20,000 cal/mole when tested in hydrogen. Cracks along the boundary are found on bi-crystals tested in vacuum and isolated voids are found on testing in hydrogen. The number of voids is directly dependent upon the amount of grain boundary sliding and is independent of temperature.

It is believed that during grain boundary sliding pure sliding occurs along the straight sections of the boundary between the boundary projections (jogs). High stresses are developed at these jogs, inducing local plastic deformation. After sufficient plastic deformation fracture occurs, producing voids. 73 pages. $2.00.

THE LIFE AND CREATIVE DEVELOPMENT OF JOHN H. TWACHTMAN (VOLUMES I AND II)

(L. C. Card No. Mic 58 2075)

John Douglass Hale, Ph.D.
The Ohio State University, 1957

John Twachtman was born of German parents in Cincinnati, August 8, 1853. He came under Frank Duveneck's influence, and received most of his art education at the Royal Academy, Munich, 1875-77. He returned home in 1878 to exhibit his Munich manner landscapes at the Society of American Artists (he became a member, 1879) and the National Academy of Design, and joined the rollicking Tile Club. In 1880 he was in Florence assisting Duveneck with his "Duveneck Boys," but he returned in the spring to marry Martha, daughter of the Cincinnati physician, John Scudder. After a wedding-painting trip of about a year the couple returned to Cincinnati for the birth of J. Alden, the first of seven children. Further study in Paris (1883-85) followed, and the artist's French period had its inception then. In 1885-86 the Twachtmans were back in America, where the painter had to take a commercial art job painting a cyclorama. The family went to Connecticut in 1888, where Twachtman began to work seriously again, winning the Webb Prize for landscape at the Society. The following year he and J. Alden Weir exhibited together and sold their entire show. Twachtman's fortunes turned. Summer students filled his classes, he joined the faculty of the Art Students' League, and purchased a farm-estate near Greenwich.

The artist's life settled into something of a routine of teaching, meeting his men friends at his New York club, The Players, and entertaining and working in Greenwich. Only occasionally did he go far from his home, as in the mid-1900s, when he painted at Niagara and Yellowstone.

Twachtman's work after 1889, although admired by advanced artists, critics, and "amateurs," was too radical for the general taste. In spite of this, he was not without awards, receiving, among others, a Silver Medal, World's Columbian Exposition, Chicago, 1893, and the Temple Gold Medal, Pennsylvania Academy of the Fine Arts, 1894.

In addition to sending work to the established organizations, Twachtman, in 1891, had a one-man exhibition; showed with Weir and Claude Monet in 1893; with his son, J. Alden, in 1900; and alone again in 1901. In 1898 he, Childe Hassam, Weir, and seven others left the Society to form The Ten American Painters.

Although well liked by friends and considered a person of "gentle enthusiasm," Twachtman was feared by many of his students. A perfectionist, never satisfied with his own efforts, he appears not to have been a thoroughly happy man. Perhaps some of his classroom severity was also the result of disappointment at not achieving general recognition. He died August 8, 1902, after a short illness.

Twachtman's art falls into four periods. The Munich period, 1874-1883, was characterized by slashing brushwork, strong darks and lights, little color, and an oily impasto ("Snow Scene," Cincinnati Art Museum). The French period, 1883-c. 1890, featured liquid pigment, few visible brush strokes, soft values, grayed colors, low skylines, more detail, and form subordinated to "mood" and pictorial qualities ("Windmills," M. Knoedler & Co., New York). The Greenwich period showed a renewed interest in impasto (dry), lighter, brighter colors, occasional use of impressionist technique, higher or nonexistent horizons, elimination of detail and "mood," subordination of pictorial quality in the interest of form, and the beginning of a search for abstract design ("The Waterfall," Addison Gallery of American Art, Andover, Massachusetts). The Gloucester period, c. 1900-1902, brought back the use of black, crisper values, less impasto, more dashing brushwork, a more direct approach, and a continued concern with abstraction ("Fishing Boats at Gloucester," National Collection, Smithsonian Institution, Washington, D. C.).

654 pages. $8.30.

THE PORTICO DE LA GLORIA OF THE CATHEDRAL OF SANTIAGO DE COMPOSTELA

(L. C. Card No. Mic 58-1467)

Marilyn Jane Stokstad, Ph.D.
University of Michigan, 1957

The Portico de la Gloria is one of the finest and best preserved monuments from the transitional period between the Romanesque and Gothic, admirably illustrating the diversity and vitality found in one of the great cathedral workshops at a crucial moment in the development of western art. This sculpture was executed under the direction of Master Matthew who received a royal grant for work on the cathedral in 1168. The portal is also dated by an inscription engraved on the lintel of the central doorway in 1188. This dissertation is concerned first with the styles within the cathedral workshop and second with the origin and later influence of Master Matthew and his assistants.

The stylistic discussion is the result of a study of the Pórtico de la Gloria and other twelfth-century sculpture made on the site and reevaluated after a comparative analysis of photographs. Available documentary evidence and previous scholarship are also reviewed. A survey was made of the political, social, and ecclesiastical history of Galicia in the eleventh, twelfth, and thirteenth centuries in order to uncover any possible historical evidence which might prove to be a contributing factor in the development of the Compostelan style. It was found that far from being an isolated community, Santiago de Compostela was a center of learning and the arts, a thriving city with a prosperous citizenry and enlightened clergy.

Master Matthew must have had several sculptors as assistants in his workshop. He himself carved the figure

of Santiago on the trumeau, the twenty-four Elders, some angels, and figures on the west wall. He must have supplied designs and added finishing touches to many more pieces. Among the other styles distinguishable on the Pórtico de la Gloria are those of the Daniel Master who executed the Prophets at the left of the center door, the St. John Master who carved the Apostles of the right embrasure of the center door and several other figures as well, and the Ezekiel Master who worked on the Prophets on the north door. Some of the figures have not been definitely assigned to an individual sculptor, although a probable relationship with one or more of the above artists has been indicated. Still other sculptors carved the bases, capitals, marble shafts, and foliage which decorate the Pórtico. A decline in quality may be seen in the sculpture of the lateral archivolts and the central tympanum.

The origins of Master Matthew's style seem to lie in Spain. Since the Compostelan workshop had been in existence for generations, the technique and style used by Master Matthew were undoubtedly derived from local tradition, an example of which is the Puerta de las Platerías. The sculpture of the Cámara Santa of the cathedral of Oviedo, itself influenced by Burgundy and the Ile de France, seems to be another of the immediate sources of inspiration for the figures of the Pórtico de la Gloria. Moreover, the decorative sculpture is similar in detail to that of the cloister of Sto. Domingo of Silos. French influence is present in iconography and composition, and thus may represent the wishes of the clergy, many of whom had traveled and studied in France. The work of the Compostelan shop after the completion of the Pórtico de la Gloria is discussed, especially the remaining pieces of the medieval choir and the sculpture found in the archbishop's palace. Finally, influence of the Pórtico beyond Santiago de Compostela is traced, illustrating the popularity of the style and its final degeneration. 362 pages. $4.65.

GEOLOGY

STRATIGRAPHY OF THE LYKINS FORMATION OF EASTERN COLORADO

(L. C. Card No. Mic 58-1199)

Thayne Leo Broin, Ph.D.
University of Colorado, 1957

Supervisor: Professor Warren O. Thompson

The Lykins formation of Permo-Triassic age crops out along the east flank of the Front Range in Colorado. In 1906 Fenneman described and defined the Lykins formation in Lykins Gulch, 9 miles north of Boulder, Colorado where it is about 550 feet thick and consists predominantly of poorly differentiated red shales, siltstones, and sandstones. Near the Colorado-Wyoming boundary, where the Lykins formation is about 1000 feet thick, the upper 750 feet consists of red clastics and the lower 250 feet consists of interbedded limestone, gypsum, and red clastic sediment. The Lykins formation in northern Colorado includes in descending order the following members: Red Hill shale (new name), Park Creek limestone (new name), Stonewall Creek shale (new name), Poudre limestone (new name), Livermore shale (new name), Forelle limestone, Glendo shale, Falcon tongue of Minnekahta limestone, Harriman shale, and Blaine gypsum. The Park Creek and Poudre limestones extend northward beyond Horse Creek, Wyoming, which is the northern limit of this study. These limestones may correlate, respectively, with the Little Medicine tongue of the Dinwoody formation (Triassic) and the Ervay tongue of the Phosphoria formation (Permian). The Park Creek and Poudre limestones crop out as far south as Lykins Gulch and Loveland, Colorado, respectively. The Forelle limestone and Falcon tongue of the Minnekahta limestone extend at least from Horse Creek, Wyoming southward to Red Creek Canyon, which is between Colorado Springs and Canon City, Colorado. In the area near Morrison, Colorado, the name "Glennon" is applied to the Forelle limestone.

Uplift of southern Colorado following deposition of the Lykins formation resulted in erosion that cut progressively deeper into the Lykins formation southward so that at Red Creek Canyon pre-Jurassic erosion truncates the upper beds of the Forelle member of the Lykins formation.

Four cross sections which extend eastward in subsurface across the Denver Basin into Kansas and Nebraska depict correlations with outcrops along the Front Range. Two additional north-south cross sections connect the east-west cross sections. Except near the mountain front on the west, surface carbonate members of the Lykins formation are represented in the subsurface by anhydrite or anhydrite with interbedded dolomite. Anhydrite beds increase in thickness eastward as intercalated red clastic beds decrease. Permian strata of Kansas are correlated with stratigraphic units along the Front Range in Colorado as follows: 1) The Stone Corral dolomite seems to be older than the Lyons sandstone. 2) The Blaine gypsum lies just above the Lyons sandstone in the Denver Basin. The Day Creek dolomite correlates directly with the Forelle limestone. The Stone Corral dolomite, which lithologically is anhydrite in the subsurface, provides an excellent marker bed in the pre-Lykins red beds of southeastern Colorado. A previously unnamed evaporite unit between the Stone Corral and Blaine gypsum, designated the "No Name" gypsum in this study, extends northward beyond the Stone Corral and has been mistaken for the Stone Corral in the eastern part of the Denver Basin.

Lithofacies maps compiled from well logs and measured sections delineate lithologic variations of the stratigraphic interval between the base of the Blaine and top of the Forelle members. Hence, three sources of clastic materials appear: 1) from the Colorado Landmass of the Ancestral Rockies, 2) from uplifted Fountain and Sangre de Cristo formations in the Canon City and Sangre de Cristo Mountain area, 3) from the Hugoton Embayment of the Anadarko Basin, probably derived from the Arbuckle and Ouachita Mountains. The Colorado Landmass, which was

not a potent source of detrital materials, coincided closely in trend and position with the present Front Range, but in northern Colorado it had a northwestward trend.

The lower part of the Lykins formation is thought to have been deposited in a neritic environment on an unstable shelf which extended eastward from the Colorado Landmass. Mud cracks and raindrop imprints in the upper part of the Lykins formation indicate a change to continental conditions. This change may occur at a color-texture break in the Red Hill shale 50 to 100 feet above the Park Creek limestone. 256 pages. $3.30.

EMPIRICAL STUDY OF RAYLEIGH WAVE DISPERSION, SOUTH AMERICAN EARTHQUAKE OF DECEMBER 17, 1949

(Publication No. 25,123)

Roy Eugene Hanson, Ph.D.
St. Louis University, 1957

Introduction

The earthquake of December 17, 1949 which occurred in the Tierra del Fuego region at the southern tip of South America was chosen for an empirical study of Rayleigh wave dispersion because of its magnitude, its geographic and geological position and because it was preceded by a foreshock of almost equal magnitude. It was believed that many problems of surface wave propagation can be better attacked by a detailed study of the dispersion curves of a particular earthquake rather than average curves derived from many quakes.

Of particular interest is the investigation of the effect of high mountain ranges, submarine topographic highs, and continental borderlands on the propagation of Rayleigh waves.

The problem of the variation of period with path and distance travelled of the "maximum phase" was investigated.

Method

Seismograms from eighty four leading earthquake observatories of the world were borrowed for this study. Of these, only 120 records from fifty five stations were suitable for analysis. The R-group was determined for each record and a graph of period versus velocity was plotted for each record for as great a range of periods as the record would permit, using the method of Press and Ewing.

Each path from epicenter to station was broken up into integral geological units and the group velocity for the observable periods were calculated for each unit by a process of addition and subtraction. From these observed or calculated "pure" curves, such interpretation of the physical structure of the regions was made as was believed valid by comparison with theoretical dispersion curves and with each other.

Results

The small scatter of the Pacific data, and the excellent agreement of this data with Oliver's theoretical and observed curves over a different set of Pacific paths, indicate that the Pacific basin is structurally quite uniform, as seen by Rayleigh waves, and is presumably simpler than other "pure" paths.

The data indicate that the border of the Atlantic Ocean is not as sharp as that of the Pacific, and that the sialic layer does not end sharply at the edge of Europe and Africa but probably terminates gradually toward the deep basins.

Low velocities to Mexico and the West Coast of the United States can most logically be explained by the intervention of lower velocity rocks associated with the Albatross Plateau and other submarine highs. A water and sediment depth of 4.7 kilometers is indicated for the southwest Pacific as contrasted to 5.57 kilometers over the Pacific basin proper.

A definite decrease in Rayleigh wave velocities was occasioned by their path through high mountains as contrasted to non-mountainous continental structure. The effect is noted for the Andes and for the Alps.

The period of the maximum wave is not strictly a function of the recording system at a station but is influenced by the distance travelled and, more particularly, by the structure of the travelled path. An increase of period with distance is noted over Pacific paths.

The dispersion data are independent of the method of recording and the period of the recording system.

Whereas the waves over homogeneous paths give a smooth dispersion curve, waves travelling over mixed paths many times show a very real dip in them with the periods most affected centering around 21 seconds. A systematic, but unexplained, difference in dispersion was noted between the foreshock and the quake.

213 pages. $2.80. Mic 58-5045

GEOLOGY AND ORE DEPOSITS OF THE MONUMENT VALLEY AREA, APACHE AND NAVAJO COUNTIES, ARIZONA

(Publication No. 22,644)

Irving Jerome Witkind, Ph.D.
University of Colorado, 1956

Supervisor: Professor Warren O. Thompson

In 1951 the U. S. Geological Survey undertook a program of uranium investigations in Apache and Navajo Counties, northeastern Arizona. The work had three major objectives. The first was to accumulate data basic to an understanding of the regional geology. The second was to appraise the Triassic strata as host rocks for uranium deposits, and to select areas favorable for exploration for concealed deposits. The third objective was to study the controls that influence uranium deposition and from this study, to establish guides useful in prospecting for uranium deposits.

Exposed consolidated sedimentary strata range in age from Permian to Jurassic. Minettes and vogesites form volcanic plugs and dikes. Several rubble pipes filled with rounded cobbles and boulders that range in age from pre-Cambrian (?) to Cretaceous are in a matrix of antigorite on Garnet Ridge.

Extensive surficial deposits, predominantly dune sand and alluvium, veneer mesa tops and form valley floors.

Five small asymetrical folds are in the mapped area; (1) the Organ Rock anticline, (2) the Oljeto syncline, (3) the Agathla anticline, (4) the Tse Biyi syncline, and (5) the

Gypsum Creek dome. Fractures cut all strata. Faults are rare, but joints are common and widespread.

Uranium-vanadium ore deposits are in the Shinarump conglomerate member of the Chinle formation (Late Triassic), a light-gray crossbedded conglomeratic sandstone that contains a few intercalated light-gray mudstone lenses. The Shinarump caps most of the isolated mesas and buttes and normally appears as a cliff about 50 feet high. It rests unconformably on the Moenkopi formation of Early and Middle Triassic age. The unconformity is marked by elongate shallow erosional depressions termed swales, and by symmetric and asymmetric channels scoured as much as 75 feet into the underlying Moenkopi formation. These channels range from narrow ones 15 feet wide to broad ones as much as 2,300 feet wide.

Sixty-two channels and channel segments were noted; of these 18 have mineralized exposures. The Monument No. 2 channel, containing one of the richest deposits in the Monument Valley area, strikes N. 18° W. and is about 1-3/4 miles long. It ranges in width in its central part from 400 to 700 feet and has been cut about 50 feet into the underlying strata. The channel floor is irregular and near its southern end is divided by a low narrow sandstone ridge that parallels the channel trend. Four types of ore bodies were noted; (1) rods, (2) tabular ore bodies, (3) corvusite-type ore bodies, and (4) rolls. The rods are cylindroidal bodies about 3-5 feet wide, 2-3 feet high, and 15-20 feet long. The tabular ore bodies are blanket-like masses of channel sediments 40-50 feet long, 20-30 feet wide, and 3-5 feet thick. The corvusite-type ore bodies are irregular-shaped masses of sediment thoroughly penetrated by vanadium and uranium minerals. Rolls similar to those mined in the Morrison formation (Jurassic) are the fourth type of ore body.

Swales and channels are important prospecting guides. Other useful guides are (1) observable uranium minerals and abnormal radioactivity, (2) channel fill, (3) channel conglomerates containing carbonaceous matter. Guides of uncertain usefulness are (1) limonitic impregnation of sandstone, (2) secondary copper minerals in channel fill, (3) an abnormal thickness of an altered zone in uppermost Moenkopi strata beneath channels, and (4) clay boulders, cobbles, and pebbles in channel fill.

Two tests for oil and gas have been drilled. In 1924, the Midwest No. 1 Gypsum penetrated 2,083 feet to the Elbert formation (Late Devonian) as a test of the Gypsum Creek dome. Although small shows of oil and gas were reported the hole was abandoned. The Navajo A-1, was completed in 1953 on Hoskinnini Mesa, and tested the southern part of the Organ Rock anticline. The hole was abandoned as a dry hole after being drilled 4,523 feet. No oil or gas shows were reported. It also bottomed in the Elbert formation. As favorable strata and structures underlie the Monument Valley area, the area is deemed worthy of further investigation.

284 pages. $3.65. Mic 58-5046

EFFECT OF PRESSURE ON CONDUCTIVITY, POROSITY AND PERMEABILITY OF OIL-BEARING SANDSTONES

(L. C. Card No. Mic 58-2277)

Donald O. Wyble, Ph.D.
The Pennsylvania State University, 1958

A pressurizing system was designed and built to simulate the effect of overburden pressure on rocks to a depth of 10,000 feet (0 - 5,000 psi). Samples of the Bradford, Weir and Kirkwood sandstones were subjected to pressures parallel and perpendicular to the bedding in this system and the changes in conductivity, porosity and permeability determined.

Decreases in conductivity, porosity and Klinkenberg permeability were measured over the 0 - 5,000 psi range. From these data, the increase of formation factor over the same range was calculated. These changes are presented in graphical form.

The cementation exponent expressed in the Archie equation was found to increase with pressure. The values of the cementation exponent as a function of pressure are shown graphically.

Porosity, conductivity and permeability were found to fall off asymptotically with increase in pressure up to 3,500 psi for samples taken parallel and perpendicular to the bedding plane of each of the three formations. The rate of change varied from formation to formation. It was also different for samples taken parallel to the bedding and those taken perpendicular to it. The rate of change of the various properties for any one direction for any formation with respect to one another tend to be proportional to one another.

A very uniform decrease of these properties was observed with increasing pressure for both vertical and horizontal samples of the Weir sand. The vertical samples of the Bradford sand showed consistently greater decreases of porosity, conductivity and permeability with increasing pressure than the horizontal samples. The Kirkwood sand responded to pressure increases in a manner similar to the Weir sand, except that the vertical samples gave a smaller decrease in permeability with increasing pressure than the horizontal samples.

Above 3,500 psi the data are not good enough to tell if the properties continue to fall off asymptotically or in a different manner. A possible explanation for the limit of the asymptotic rate around 3,500 to 4,500 psi is that this represents the maximum pressure which the formations have undergone during their geological life as a result of burial. It is postulated that below this pressure previously closed openings are being reclosed whereas above this pressure strong forces are needed to reduce further the openings in the rock. 81 pages. $2.00.

HEALTH SCIENCES, NURSING

FACTORS BEARING UPON SELECTION OF NURSING EDUCATION AS A PROFESSION

(L. C. Card No. Mic 58-2061)

Helen Elizabeth Dorsch, Ph.D.
The Ohio State University, 1957

Although the need for teachers of nursing has previously been established, little or nothing has been done to determine what factors influence nurses toward or away from preparation for the teaching of nursing.

Purposes. In this study of the factors that influence nurses toward or away from preparation for teaching of nursing, the major purposes were to determine (1) those factors that influence nurses toward preparation for teaching of nursing; (2) those factors that influence nurses away from preparation for teaching; and (3) the ways in which these factors may be used to encourage nurses to prepare to be teachers of nursing.

Procedures. A questionnaire was developed to determine the influencing factors. To test the effectiveness of the instrument, a pilot study of thirty-five student nurses currently enrolled in basic nursing programs was made. Names of student and graduate nurses for the study were obtained from the five schools in Ohio which have fully accredited collegiate nursing programs, The Ohio State Nurses' Association, and The Ohio Nurses' Review. Data were collected from 561 questionnaires and 90 interviews.

Conclusions. The following conclusions were reached regarding factors which influence nurses toward preparation for the teaching of nursing. Marital status, interest in teaching, interest in students, satisfactions received from teaching, and opportunities for continued professional growth exercise the most influence upon student nurses and graduate professional nurses as they consider plans to prepare to be teachers of nursing.

Time and money necessary for preparation, preparation outside of working hours, inadequate salary, and limited amount of patient contact are factors that divert nurses' interest away from preparation for teaching of nursing.

Ways of encouraging nurses to prepare to be teachers of nursing may be to employ married faculty members, to extend informational services about advanced programs in nursing, to provide individual and group teaching experiences, to furnish guidance workers with information about programs in nursing, to improve counseling and guidance services, to improve basic and advanced nursing programs, to enhance the prestige of teachers of nursing, to provide financial assistance, to provide for job satisfactions, and to improve assistant-instructor programs.

179 pages. $2.35.

A STUDY OF SOCIAL STATUS AS A DETERMINATE FACTOR IN THE DISTRIBUTION OF PROMOTIONS TO NURSES

(L. C. Card No. Mic 58-2128)

Alice Elizabeth Keefe, Ph.D.
New York University, 1958

This study is concerned with social stratification in nursing to determine if status is related to the selection of potential leaders in the nursing prefession, for promotions. Any position above the beginning position was considered a promotion and signified professional approval.

It seems advisable to state some beliefs that provided a reasonable foundation for the investigation.

1. Professional promotions should relate to competency based on intelligence, preparation and ability.
2. It was assumed that the nurse who attained professional leadership usually received a first promotion within five years after graduation.

The investigator did not make the assumption of single causation in regard to the influence of social class on promotions. The total pattern of promotions has been assumed to be significant in relation to the total pattern of the status structure. There was no test made for one-to-one correspondence.

This study was designed to test the following hypothesis:

1. That promotions are received by proportionately more nurses graduating from diploma granting programs than from degree granting programs.
2. That, in general, social class level is lower among nurses who receive promotions.

The total population for the study consisted of 882 nurses. They were considered in dichotomous groups, based on graduation from either diploma granting or degree granting programs in nursing. School records supplied information for social class placement which was based on fathers's occupation. Placement was made on the basis of a single criterion, occupation, which correlates .91 with the multiple criteria of six status characteristics described by Warner et al (Social Class in America.) Other information collected concerned: age, religious affiliation, nationality of parents, education of parents, I.Q. or scholastic ability and reading scores, and course grades in school. These factors were analysed in terms of their relationship to promotions within each of the two types of programs.

The statistic chi-square was used to test the null hypothesis or the hypothesis of no difference for proportional distribution. The five per cent level of probability was considered significant. Correlation techniques were employed to determine the extent of similarities or differences between the two groups and among the represented

social classes as related to promotions. Promotional patterns were sought.

It can be concluded with confidence that social status is a determinate factor in the distribution of promotions to nurses; members with lower social class backgrounds are favored.

Social class seems to be an ubiquitous factor since it has been possible to identify it with other variables tested: religion and nationality of parents, education of fathers, reading and learning ability of daughters and choice of nursing program.

The degree granting programs provide proportionately more members for positions above first level than do the diploma granting programs.

Scholastic ability had little or no relationship to promotions and only moderate relationship to course grades for the diploma group and no relationship for the degree group. Social class placement had little or no relationship to course grades.

While this study has revealed that social class background is correlated with the distribution of rewards to nurses, the direction of this correlation is counter to that determined from the studies of other groups.

The professional implications center around the need to reappraise nursing to determine what individual qualities fit the demands of the tasks of the profession; and then to gear recruitment and training toward realistic goals to relieve acknowledged shortages. 135 pages. $2.00.

HEALTH SCIENCES, PATHOLOGY

PATHOLOGY AND BACTERIOLOGY OF ABORTION AND PERINATAL DEATH OF YOUNG IN RABBITS, SHEEP AND GOATS INDUCED BY LISTERIA MONOCYTOGENES

(L. C. Card No. Mic 58-2365)

Chintamani Singh, Ph.D.
Michigan State University, 1956

Studies on the pathology and bacteriology of abortion and perinatal death (stillbirth, and early death) of young in rabbits, sheep and goats induced by Listeria monocytogenes were undertaken to help explain the role of the bacterium in this syndrome.

Pregnant, non-pregnant and male rabbits and goats and pregnant sheep were exposed either by conjunctival instillation of suspensions of the bacterium or by adding them to the drinking water.

Conjunctival exposure of pregnant rabbits resulted not only in a marked conjunctivitis but also in abortion when the doe was exposed early in gestation; when the exposure was late in gestation, the young were either stillborn or died within a few days due to listeric septicemia. Conjunctival exposure of non-pregnant rabbits resulted in marked conjunctivitis and a low-grade and otherwise inapparent infection. Conjunctival exposure of goats resulted in a very mild eye reaction but caused death of a pregnant goat due to listeric encephalitis and induced encephalitic lesions in a castrated male goat.

These findings establish the fact that the infection resulting from conjunctival instillation of L. monocytogenes does not remain localized in the conjunctiva.

Oral exposure of pregnant rabbits, sheep and goats resulted in abortion if the dams were exposed early in testation; if the exposures were late in gestation, the young were either stillborn or died within a few days due to listeric septicemia. Non-pregnant animals exposed in the same manner suffered a low-grade inapparent infection.

L. monocytogenes was readily isolated from aborted fetuses, young born at term, placenta and from the dams which died due to septicemia.

The results suggest the uterus as the principal target of infection in pregnant animals. If the entire conceptus was expelled, the defense mechanism of the dam could successfully combat the relatively few remaining bacteria as in the non-pregnant. However, retention of infected conceptus (1) caused localized suppuration, (2) constituted a source of infection which resulted in subsequent abortions if the dam was rebred within 6 days, or (3) caused death from septicemia.

No evidence of immunity could be demonstrated in rabbits (at least within 2-6 months) following survival of any form of exposure under the conditions of these experiments.

The various clinical syndromes of listeric infections apparently vary with species, route of exposure and state and stage of pregnancy.

The most prominent pathological findings in aborted fetuses and the young which died perinatally included necrotic foci in the liver and less frequently in the heart, lung, kidney, stomach and gall bladder, with necrotic debris, in the hepatic bile ducts; fibrinous exudate on the surface of liver and intestine; moderate hydroperitoneum. The bacterium could be demonstrated in tissue sections of most of these organs. Examination of dams which died or were sacrificed revealed necrotic endometritis with variable amount of caseous to purulent exudate. Numerous necrotic foci and thrombi were noticed in the myometrium. The bacterium could be demonstrated in tissue sections of the uterus including the cotyledons. 152 pages. $2.00.

HEALTH SCIENCES, PUBLIC HEALTH

A STUDY OF THE FACTORS ASSOCIATED WITH THE ADJUVANT EFFECT OF WATER-IN-OIL EMULSIONS CONTAINING INFLUENZA VIRUS

(L. C. Card No. Mic 58-2011)

Robert Warren McKinney, Ph.D.
University of Michigan, 1957

A model system has been developed and defined, with which the adjuvant effect of emulsified vaccines containing influenza virus was evaluated. In relation to the enhancement of antibody production to influenza virus vaccine, because of the use of an adjuvant, the objectives of the study were two-fold: 1) To attempt to determine the relative importance of protection of the antigen against destruction and elimination, of the role of the local cellular response, and of the rate of antigen release from the site of inoculation and, 2) to ascertain whether mechanisms other than those given might be operative in the adjuvant effect of water-in-oil emulsions containing influenza virus.

It has been shown that in order to induce an adjuvant type antibody response, to emulsified influenza virus vaccines, certain physical and chemical criteria must be satisfied: 1) The form of the emulsion that is effective is the water-in-oil type; 2) it is reaffirmed that the oil used should be a mineral oil. Water-in-oil emulsions made with an animal fat were shown to be non-effective.

Studies on the temporal relationship of enhanced antibody response and vaccination with "standard" adjuvant vaccine have shown that the initial peak level of antibody produced is dependent on repositing the virus in situ for about 16 days. This critical relationship was shown with mineral oil emulsified vaccines and cotton pellet implants into which virus was introduced.

Studies on the rate of breakdown of emulsified vaccines carried out by the removal of the site of inoculation, by irradiation designed to block further antibody production, and by direct measurement of the rate of release of P^{32} from emulsions prepared in the same manner as "standard" adjuvant vaccines, demonstrated that mineral oil emulsified vaccines tend to release a large and effective portion of their antigen early after inoculation. This release appears to occur as early as 8 hours after vaccination and, by 16 days the major portion of antigen responsible for determining the initial peak of antibody has been liberated.

Nevertheless, it was shown by removal of the granulomata after vaccination, that a slow continuous release of antigen from the site of inoculation is critically important in maintaining high antibody levels for prolonged periods of time. Data to support this interpretation were derived from experiments in which small and diminishing doses of aqueous vaccine were given over a long period of time.

The concept that adjuvant vaccine induces the formation of a "local antibody producing organelle" responsible for major contributions to the level of circulating antibody has been shown to be inadequate.

Data derived from experiments in which virus in saline was inoculated into an inflamatory site, induced by the implantation of cotton pellets which do not appear to retain in virus in situ, suggest that one of the essentials of the adjuvant effect is the production of an acute inflammatory response, which persists for a critical period, during which time antigen is locally available to interact with these cells. It has been suggested that the inflammatory response may also be related to the efficacy of non-adjuvant vaccines and antibody production, and that further investigation into the relation of the inflammatory process to enhancement of antibody production might provide information leading to a better understanding of the antibody response. 122 pages. $2.00.

HISTORY

HISTORY, GENERAL

THE CLARKSVILLE LEAF CHRONICLE, 1808-1956, A HISTORY

(Publication No. 24,478)

Lewis Paul Hyatt, Ph.D.
George Peabody College for Teachers, 1957

Major Professor: Jack Allen

The history of the Clarksville Leaf Chronicle and its forerunners covers almost a century and a half of the development of Montgomery County, Tennessee, and its county seat, Clarksville. The frontier settlements of the county began in 1780, and the Clarksville Chronicle was established about 1808. Clarksville developed as an economic and cultural center of an agricultural area whose major enterprises were tobacco, corn, wheat, livestock, and general farming. The area also supported a diversified economy including various kinds of small industry and trade.

The files of Clarksville newspapers for the period from 1808 to 1857 are incomplete but are of sufficient quantity to provide considerable information for this study. The files encompassing the period from 1857 to 1956 however, are, with limited exceptions, complete. Because of the Civil War the Chronicle was forced to suspend operations from 1862 to 1865. The files of the Tobacco Leaf, another forerunner of the Leaf Chronicle, are almost complete from its establishment in 1869 until it merged with the Chronicle in 1890.

The early forerunners of the Leaf Chronicle were mainly four-page journals devoted to political news and advertising. As these papers grew and developed they became complete newspapers including special sections and departments designed to fill the needs of people in a complicated, modern society.

The ownership and management of these newspapers changed many times. During some periods shifts came often, but at other times the papers were owned and managed for many years without change. The titles under which the papers operated have also been subject to much alteration. The Leaf Chronicle of 1956, however, had not undergone a significant title change since the merger of the Chronicle with the younger Tobacco Leaf in 1890.

Editorial policies can be readily traced through most of this long span of years. In the steady course of human affairs, these papers were almost always eager to express an editorial policy on some side of leading issues of the day. Major national political policies were consistently of strong concern.

The early Clarksville newspapers were established with a small capital investment, but publication costs were also small. The limited income they received from government printing contracts, subscriptions, and some advertising, was sufficient. In later years the business of the Leaf Chronicle became increasingly more complicated. An unusual feature of its business operations was its family of affiliated weekly newspapers in Middle Tennessee which began to be developed after 1940.

One of the most significant changes has been in the news coverage in these papers. Many kinds of news in 1956 issues of the Leaf Chronicle would not have been

considered newsworthy in earlier Clarksville newspapers. The sports page, comic page, society news, farm page, and many other kinds of modern news coverage can be traced through their year by year development. On one score the Leaf Chronicle and its predecessors have maintained a consistent policy. They were able to survive and prosper because they served the basic needs of their circulation area centered in Clarksville. Their first duties have always been community leadership and community service. 263 pages. $3.40. Mic 58-5047

THE SIGNIFICANCE OF SELECTED ASPECTS OF WOOD TECHNOLOGY FOR WESTERN CULTURE

(L. C. Card No. Mic 58-1160)

Gerhardt William Neubauer, Ph.D.
University of Minnesota, 1956

Few artifacts have been preserved from the Mystic Age of wood, but it is safe to infer that the destinies of primitive peoples hinged to a significant degree upon the facility with which they manipulated that resource. Primitives relied upon wood in all aspects of their daily living. Rudimentary tools and weapons were fashioned from wood or combinations of wood, stone, bone, and horn. Dwellings were made of wood or contained wooden framing which reinforced walls of wattle and daub. Vessels and vehicles were of wooden origin, while timber trackways attest to the mobility of western Europeans prior to the dawn of recorded history. Many primitive peoples worshipped sacred trees and groves which they regarded as sanctuaries of the life spirit.

The development of metal tools reflected significant advances in wood technology. On the southern shores of the Mediterranean and in the Middle East, craftsmen had reached an advanced level in wood fabrication. Egyptian artisans employed many of the same tools and construction techniques which are currently utilized by woodworkers. They were familiar with an elementary form of plywood and frequently used a type of peg construction in securing joints. Artisans employed a variety of devices for obtaining bent wood, and felloe construction and the fashioning of spokes provided early evidence of the advantages inherent in interchangeable parts manufacture.

Among the earliest fabrications of Egyptian artisans were chests and coffers of substantial construction. Greek and Roman craftsmen of the Eclectic Age fashioned similar articles and further exercised their talents upon furniture and appointments constructed from exotic cabinet woods. Classical economy had its origins in the wood-using crafts and the age represented, essentially, an era of synthesis in which craftsmen borrowed the structural techniques of Egyptian and Middle Eastern artisans which they adapted to their unique requirements.

The Realistic Age was characterized by the uncertainties marking the fusion of Roman and Germanic cultures and the turbulence accompanying the Norse incursions. Modes of living were appreciably altered and hand craftsmen frequently led a tenuous existence. Castle dwellers attained a measure of self-sufficience, but manorial accomplishments were supplemented by the efforts of itinerant craftsmen.

The activities of Neolithic farmers constituted the initial drain on the timber resources of western Europe. A second assault wave consisting of monastic groups and peasant pioneers bent upon clearing more land for cultivation completed the task of forest decimation.

Modern furniture-making practices were presaged by the substitution of panel fabrication for plank construction and by the introduction of specialization into the woodworking crafts. Guilds, like those of the woodcarvers who embellished the choir stalls of medieval churches, were organized, but economic and political factors conspired to negate their influence.

Economic conditions and the level of technological development made propitious the mechanization of woodworking and initiated the Pragmatic Age. Near the close of the eighteenth century, Sir Samuel Bentham patented nearly all types of woodworking machinery. Improvements and further inventions followed in rapid succession, and eventuated in a demand for wood and wood products which resulted in the development of national markets and the stimulation of factory production.

The opening of the twentieth century witnessed the greatest of the lumber harvests, after which demand fluctuated. However, new uses for wood were developed, and more attention was given to the conservation of that resource and to its more complete and rational utilization.

A material with such an honorable tradition of service needs to be more thoroughly explored in general education courses at all educational levels, and its cultural and technological significance need to be more completely assessed in industrial arts courses and in pertinent academic disciplines. 956 pages. $12.05.

HISTORY, MEDIEVAL

TRAVEL IN MEDIEVAL FRANCE (1300-1450)

(L. C. Card No. Mic 58-2456)

Marjorie Nice Boyer, Ph.D.
Columbia University, 1958

France is a natural corridor for travel by land between England, the Low Countries, and northeastern Germany on the one hand and Spain and Italy on the other; and at the opening of the fourteenth century France still was benefiting, as far as travel was concerned, from its geographical position. Yet the history of travel in France for the period 1300-1450 has not been written. The present work was undertaken in the hope of filling this gap and of making a contribution to social history. The chief source for the study is the record of expense accounts, which provide for journeys a multiplicity of authentic details to be found in no other type of data.

The Middle Ages were a period when serfs in France were bound to the soil, but it also was the age of great pilgrimages, of knights-errant, and of the revival of trade. It was the age of the sustenance economy, but it also was a time when kings and barons were in motion from one part of their scattered domains to another, as in later centuries they were not. Governmental functions required

royal officials, town representatives, and baronial agents to be ever on the road; and they were joined, among others, by church administrators and managers of property, students, litigants, messengers, professional entertainers, and artisans.

Travellers preferred land to water travel; but roads in France seem ordinarily to have been narrow dirt routes with repairs largely limited to making "bad spots" passable. Bridges, of which there were many, seem to have been of particular concern in medieval France. In the records, travellers generally were mounted, and litters or chariots were rarely used. We have found no evidence of organized relays of horses, and there is some indication that there was a shortage of steeds. Instances of the illness or death of horses are frequent and there are repeated complaints of the seizure of horses.

Non-commercial travellers relied heavily, for financing their journeys, upon the transportation of specie, for letters of credit were infrequently used. Resort to pawning was a common practice. However, it was possible for travellers to minimize the use of money by relying on charity and hospitality. There were hospices especially maintained to shelter the indigent passer-by; lords often could expect to be entertained, sometimes lavishly and sometimes in niggardly fashion, by their peers and their political inferiors. Nevertheless, travellers relied chiefly on inns for their lodging. Here the important part of the entertainment was not the beds but the food, which the traveller was expected to purchase from the host. Lords were preceded in their itineraries by harbingers who saw to the provision of lodging and preparation of food, and the preference of lords for an itinerant life was due in no small measure to the fact that their servants were able to make them so comfortable.

Expense accounts provide voluminous information on the speed of travel. Although there are records of messengers travelling in four days from Paris to Avignon at the rate of about ninety miles a day, it was uncommon for a day's journey to be much more than thirty miles.

At the middle of the fifteenth century travel in France was at a low ebb. Although at the close of the Hundred Years War, travel began to recover, France permanently had lost certain factors making it a travel center. Among these were the modification of a certain international viewpoint, the removal of the papacy from Avignon, the decadence of the fairs of Champagne, and the loss by the University of Paris of its outstanding attraction for foreign students. 225 pages. $2.95.

THE GERMAN-JEWISH COMMUNITY: STUDIES IN ASPECTS OF ITS INNER-LIFE (1648-1806)

(L. C. Card No. Mic 58-2241)

Herman Pollack, Ph.D.
Columbia University, 1958

On the basis of studies of smaller units of culture (the interior of the home and clothing; the synagogue, Sabbath, and festivals; birth, marriage, and burial; education; foods and table customs; folk medicine, popular beliefs and remedies), an attempt was made to "reconstruct" the inner-life of the German-Jewish community from 1648-1806 - -, which was also a significant period in the general history of the entire region. ("Inner-life" is a descriptive term for what is usually referred to as "culture," or social life.) Various customs were dealt with to describe the cultural life of the German-Jewish communities of that period. Some practices were of ancient origin, part of a widely diffused tradition, and others were local in character, resulting from a crucial event or the innovation of a scholar. Although there were different aspects of the inner-life of the community, a relationship existed between them as parts of an "overall pattern." The sources for the various phases of culture were derived primarily from the popular, informal literature of that time.

The geographical boundary of this study consists of the area generally known as the Holy Roman Empire, namely, the German lands, Austria, Bohemia, and Moravia. The end of the Thirty Years' War, in 1648, marked the rebirth of Jewish communities in Germany. The communities were afforded new political and social opportunities by German rulers in their effort to rebuild a war-torn country. Another influence in the development of Jewish communities after 1648 was the migration and settlement of East European Jews in Germany following the Chmielnicki pogroms.

The "primary" term for the area where Jews resided was di gas (Yiddish), and, secondarily, rehob ha-Yehudim (Hebrew) or Judengasse (German). The German-Jewish community had no "physical" (topographical) continuity in the 17th and 18th centuries, but there was "social" continuity, made possible by religious tradition (which embraced every conceivable phase of human experience) and folk-practice. Yiddish (i.e. Middle Yiddish, ca. 1500-1700) was the vernacular language in the Jewish community. The folk-culture was a medium of popular education. The wide distribution of "chapbooks" and "pocketbooks" enabled men and women to read and study ethical and religio-legal material, which was written in a simple language and illustrated by aphorisms and tales. Although the Jewish community was socially isolated by the German political authorities, this did not prevent informal association with non-Jews. Individuals who lived in the gas felt the impact of the secular ideas of Humanism, the Renaissance, and German Haskalah (Enlightenment).

Popular beliefs and customs were influenced by the lore of the Cabala and practices then current in the German environment. This was observable, in particular, in relation to the "crises of life" and folk-medicine. Customs such as Holekreisch, Todtentanz, Johannes Feuer, indicate the effect that German folklore must have had on Jewish social life.

After 1648, musar (Jewish religio-ethical) literature became more and more didactic. The writers of musar were not only "mentors" in daily living, but also outspoken critics interested in correcting communal weaknesses and abuses. Thus, the popular literature of that period did not conceal those incidents that would not present an "ideal" picture of the German-Jewish community. The customs and institutions which were used as examples of the inner-life of the community mirrored the social experiences of "anonymous" persons in history. The scattered "record" of daily practices formed a "diary" of communal life, which was revealing for the structure and outlook of the German-Jewish community prior to the era of Jewish Emancipation. 461 pages. $5.90.

THE DE VITA ET MORIBUS PHILOSOPHORUM OF WALTER BURLEY: AN EDITION WITH INTRODUCTION

(Publication No. 22,637)

John Oliver H. Stigall, Ph.D.
University of Colorado, 1956

Supervisor: Professor S. Harrison Thomson

This edition of the De vita et moribus philosophorum of Walter Burley is the first edition of the fourteenth century treatise, and is based upon a collation of six of the earliest known extant MSS. None of these six copies is ascribed to Burley, and, although the author was English, none is of English provenance, nor in an English hand. These six MSS are widely separated at present: they are in London, Valencia, Vienna, Florence, Milan, and Paris. There are probably more than two hundred MSS of the De vita in existence, of which approximately one hundred are listed herein. There are also a number of early editions. A previous non-critical edition in Tübingen, 1886, by Hermann Knust is based upon a selection of fifteenth and early sixteenth century printed editions.

This work was very well known in Europe for more than two centuries, as indicated both by the wide geographical distribution of MSS and by the successive series of MSS and editions from the mid-fourteenth well into the seventeenth century. Most of the surviving MSS are Central European with an overwhelming majority from Northern Italy, Switzerland, South Germany, and, above all, Bohemia. Prague contains the greatest single concentration of MSS.

The De vita is a revival of history in biographical form. It comprises some one hundred fifty lives of pagan philosophers and writers of classical Greece and Rome spanning a period of ten centuries from Thales to Priscian. It is essentially an example of florilegial literature and in its composition Burley was careful to use such sources as were available to him. In at least one instance, that of Diogenes Laertius, his probable original source, a twelfth century Sicilian translation from the Greek into Latin, presumably has perished. In detail, Burley is sometimes inaccurate or credulous, but the consensus of modern scholarship affirms the quality and lasting value of his achievement.

The author, Walter of Burley, was the first prominent member of a subsequently distinguished family. He was an English secular priest, a pupil of Duns Scotus and a rival of William of Occam, a socius Sorbone, the close friend and associate of the bibliophile and statesman, Richard de Bury, Bishop of Durham, and the eldest of the famous group of Fellows of Merton College, Oxford, in the fourteenth century. He was a trusted envoy of Edward III to the Papal court at Avignon, and was tutor to the king's eldest son and heir, Edward the Black Prince. Most important, however, Burley was probably the most famous commentator of his age upon the physical and logical works of Aristotle, and his treatises were for centuries standard texts in the great European Universities. His most famous honorific title, 'Doctor planus et perspicuus' was a contemporary tribute to the clarity and penetration of his exposition. The dates of Burley's birth and death can be established only approximately, but he was probably born in 1275, and died ca. 1346. He was one of the last great English mediaeval cosmopolitans, and spent much of his time abroad in France, Italy, and, probably, in Germany.

The De vita enjoyed amazing contemporary and continuing popularity, and was also a source of inspiration for successive generations of authors in Italy, Spain, Germany and Bohemia. It is also probable that the treatise had a direct influence on Chaucer in the Canterbury Tales.

The De vita was more than a popular example of mediaeval light literature. A perennial favorite, it survived to become an important influence upon the writers and literature of early humanism. 394 pages. $5.05. Mic 58-5048

HISTORY, MODERN

THE AGRARIAN REVOLT IN MICHIGAN, 1865-1900

(L. C. Card No. Mic 58-2316)

Richard Harvey Barton, Ph.D.
Michigan State University, 1958

Following the Civil War, economic activity expanded rapidly in the United States. While agriculture shared in this growth, the nonagricultural occupations were expanding at a faster pace and were absorbing a greater portion of the nation's resources and wealth.

This relative decline in the agricultural industry was the cause of dislocations in the older farming sections of Michigan. The opening of the Western grasslands to farmers, the development of through transportation, and the appearance of new machinery and techniques meant that the new agricultural areas could produce more economically the cash crops which had been the mainstay of Michigan's agricultural prosperity. For many in the state, farming was no longer a profitable occupation. In order to adjust to this new situation, the Michigan farmer had to place less reliance upon wheat, beef, and wool as cash crops, and more attention was directed toward a diversified system.

This dislocation and transition caused many in the rural areas to turn to group action. The Michigan State Grange, the Farmers' Alliance, and the Patrons of Industry were formed in an effort to restore and then advance the economic and social status of the agriculturalists. The cooperative activities of groups failed to improve the economic conditions of the farmers but they did improve the social position by broadening rural outlook.

Through the use of farm organization and political activity, the Michigan farmers attempted to solve their major problems. Because of the rural protest movement, railroads and some other corporations were subjected to a greater degree of state regulation. Also, the taxation burden was more equitably distributed by placing additional corporate property upon the tax rolls of the state. Advances were made in the area of pure food and drug regulation by the creation of the office of Dairy and Food Commissioner.

The trust and currency questions were thoroughly debated by the rural groups. Although these were largely

national problems, the farmers' agitation was significant in focusing public attention upon them and hastening the formulation of definite national policies.

Political activity originating from rural unrest often upset political calculations within the state. The Greenback party attracted enough support to force the Democrats to accept fusion on their terms. This resulted in the election of Governor Begole in 1882. Later, the rural movement found a vehicle for expression in the People's party which participated in three state campaigns.

From 1896 to 1900 the reform movement reached its climax in Governor Hazen S. Pingree's administrations. More constructive legislation was enacted than in any previous period since the Civil War.

In addition to specific reforms, the farmers' movement was responsible for making the government a positive force in society. When the farmer could not maintain his position in competition with more powerful groups, he turned to the government and asked it to intervene. First, the demand was for regulation of the other fellow, but the next step was to ask for a permanent intervention in order to maintain agriculture's role in the economy. Farmers abandoned their earlier reliance upon laissez-faire doctrines and accepted a greater degree of governmental participation in the life of the nation. 230 pages. $3.00.

THE ANTE-BELLUM CHARCOAL IRON INDUSTRY OF VIRGINIA

(L. C. Card No. Mic 58-2233)

Samuel Sydney Bradford, Ph.D.
Columbia University, 1958

The first attempt to erect an iron furnace in Virginia occurred between 1619 and 1622. This furnace, Falling Creek furnace, was destroyed by the Indians in 1622, however, and it was not until Colonel Spotswood built his Germanna ironworks in 1716 that Virginia's iron industry was successfully established. After 1716 the iron industry in Virginia expanded rapidly. By 1800 even the westernmost part of the state had several ironworks within its borders. Growth in the iron industry continued until 1836, after which time the industry in Virginia exhibited little increase, excepting the ironworks in Richmond and Wheeling.

The pre-Civil War iron industry of Virginia and other states was a highly individualistic industry which revolved about its many ironmasters. Many Virginia ironmasters had moved into the Old Dominion from other colonies and states, especially from Pennsylvania. Numerous ironworks were operated by partnerships composed of two or more ironmasters; but after 1830 more and more iron businesses were incorporated. Capital for furnaces and forges always seemed difficult to obtain, but ironmasters were usually able to secure funds or credit from fellow businessmen, banks, or commission-merchants. Much capital in Virginia's iron industry, moreover, came from without the state.

Ironmasters could build, purchase, or rent ironworks. The latter method was the most popular, since it was the easiest way to make a start in the iron industry. A furnace or forge, or both, was usually the center of a self-dependent community, which consisted of the ironworks, laborers, houses for the workers, and farm land. These "iron plantations" remained the backbone of Virginia's ante-bellum iron industry. They were dominated by the ironmasters, who sometimes attempted to run their furnaces and forges. For the most part, however, hired managers who were as vital to the iron industry as overseers were to plantations, directed the operations of ironworks.

Labor at ironworks was comprised of free and slave workers, except in what is present-day West Virginia, where slaves were few in number. Even east of the Alleghenies, where numerous slaves were used in the iron industry, white workers always carried out the skilled work; but many white workers also performed nonskilled labor. Ill-paid, except for skilled labor, white workers were boisterous and rowdy, they never fearing to leave an ironworks for the flimsiest of reasons. Slave workers, most of whom were hired by ironmasters, were bound to their jobs at ironworks. Far from their homes, hired Negroes labored long and hard, received poor food and clothing, and were controlled by means of severe discipline. At ironworks, as on plantations, the whip was the sceptre of lordship over the Negro. Nevertheless, many slaves attempted to flee from ironworks, some successfully.

Not the least of the ironmaster's problems was the selling of what he made. Basic products, such as pig and bar iron, always had to be disposed of, plus whatever castings or other products an ironmaster made. Products of ironworks had to be of good quality if they were to sell well, and one of the ironmaster's greatest problems was maintaining high quality in his products. It was a problem that had to be constantly faced, for good Northern iron was readily available in Virginia. European iron also invaded the Old Dominion, and because of it the tariff was about the only issue on which ironmasters took a political stand. They consistently urged higher duties on imported iron. They acquired some protection from imported iron until 1846; thereafter little tariff protection was given to ironmasters. Placing Virginia ironmasters at a disadvantage, also, was the fact that Virginia did not develop an effective railroad net in the 1840's and 1850's. Thus, as in South Carolina, Virginia ironmasters in the last two decades prior to 1861 found it hard to stay in business. Failure to adopt newer methods in ironmaking also placed Virginia ironmasters at a disadvantage in meeting competition from Northern and British iron.

By 1861 the Virginia iron industry was in a very depressed state. It underwent a temporary revival in the early years of the Civil War, but by the war's end the industry had been dealt its death blow. 210 pages. $2.75.

HENRY WILLIAMS SAGE, 1814-1897: BIOGRAPHY OF A BUSINESSMAN

(L. C. Card No. Mic 58-2481)

Anita Shafer Goodstein, Ph.D.
Cornell University, 1958

In 1832 Henry W. Sage began his career as an employee of his uncles, merchants and shippers in Ithaca and Albany, New York; five years later he became an independent merchant. From 1837 until 1854 his business

was characterized by a series of partnerships, steady expansion despite limited capital, and increasing concentration on the lumber trade.

The second phase of Sage's career began in 1854 with the building of a lumber mill at Bell Ewart, Canada; in 1864 Sage built a second mill at Wenona, Michigan. In each case he bought out the partner with whom he had begun the enterprise; after 1868 he was to have no major partners except his sons. Each mill was considered a "mammoth" at the time it was constructed; each required that the entrepreneur develop a community to service the mill: stores, homes, railroads, schools, churches. In Michigan Sage generally owned the land from which timber for the mill was procured; most of it was purchased from the federal government at the minimum cash price or less when scrip was used. High profits were based on cheap stumpage. Sage owned lumber yards in Albany and New York City and for short periods in other cities. The Canadian mill was sold in 1869; the Michigan mill was shut down in 1892. Sage's greatest personal satisfaction as well as his justification for wealth and prestige came from his achievements as a manufacturer. Nevertheless by the late eighties it seemed clear that greater profits might be earned from investment in lands than from manufacturing and manufacturing was ultimately abandoned.

Sage's first substantial purchases of timberlands were intended to supply the Michigan mill; later he purchased for investment largely in Michigan, Wisconsin, Alabama and Mississippi. In 1893 over 500,000 acres were turned over to the Sage Land & Improvement Company. These lands were to produce large profits; the southern land account alone netted approximately 700% profit. After Sage's death the S. L. & I. Co. continued to invest in timberlands largely in California.

In the period 1871-1897 Sage invested more than four million dollars in securities, mostly railroad securities but also county and township bonds, some industrials, bank stocks, and government securities. Between 1883 and 1896 he invested more than $350,000 in western mortgages. As an investor in lands Sage was shrewd and almost always successful; as an investor in securities Sage was less successful. He suffered severe losses which, though they confirmed his conservative distrust of corporations, did not lead him to favor government regulation.

The family owned and managed enterprise was Sage's concept of the ideal business firm. He was as suspicious of his fellow businessmen as of labor organization and government regulation. When he entered business associations he did so reluctantly and continually sought control. A man of intense application and drive Sage could neither delegate nor share authority. He operated on the assumption that self-interest controlled business behavior and he had faith that business success meant the triumph of personal worth and national well-being.

Cornell University was a major beneficiary of Sage's wealth and interest. His gifts to the University amounted to substantially more than a million dollars. As President of the Board of Trustees from 1875 until his death, Sage wielded considerable and occasionally dictatorial power. His interest lay in insuring Cornell's success as an institution rather than as an educational experiment. His influence was therefore conservative and in the period of the University's greatest financial troubles perhaps wise.

452 pages. $5.75.

RAILROADS IN THE ARMISTICE OF 1918

(L. C. Card No. Mic 58-1844)

Edwin T. Greninger, Ph.D.
University of Pennsylvania, 1958

Supervisor: Dr. Lynn M. Case

Basically this is a study of the problems which arose during the fulfillment by the Germans of the requirement in Article VII of the Armistice of 11 November 1918 for 5,000 locomotives and 150,000 freight and passenger cars. Originally the Allied expected complicance within thirty-one days in order to insure that the German army would be handicapped by the loss of the rolling stock in case Germany tried to renew hostilities. At the same time they planned to use the equipment for their own armies and eventually to turn it over to French and Belgian railroads as replacements for material captured by the Germans in 1914. These desires were not immediately realized. This was the first time railroad rolling stock had been required in an armistice. As a result the supervision exercised by the Allies was faulty. They were slow in assembling the supervisory bodies, in determining the categories of equipment and the amount in each, and in settling the fate of abandoned rolling stock. Inspection standards and the large number of rejections stemming from them also contributed to the delay by forcing the Germans to overhaul much of the stock before presentation. Reduced efficiency in German railroad shops and the reluctance of Germans to overhaul much of the stock before presentation. Reduced efficiency in German railroad shops and the reluctance of German volunteers to accompany the stock to the reception stations impeded the delivery. While this was occurring, the Allies discovered that they had to permit diversionary use of portions of the stock if they wanted the repatriation of their soldiers held prisoner to proceed (Article X), and that the Germans were withholding small amounts for the transportation of relief supplies to Poland (Article XVI). As a consequence of all these factors the quotas were only partially filled by 17 January 1919. Because fulfillment had not been achieved by this date, the Allies imposed the penalty which earlier they had warned would be levied. However at the last minute they substituted agricultural equipment in lieu of seeking more rolling stock. Failure to consult the Germans beforehand on this change resulted in arguments which lasted until the inauguration of the Dawes Plan because agreement could not be reached on the value of replacements for the farm tools no longer on hand.

By mid-March 1919 the 19,021 cars missing from Alsace-Lorraine (Article VII) were delivered while the larger quotas were nearly completed. Then a decline occurred. Many of the missing quantities were reserved for the transportation of penalty tools and other items, and another group was composed of cars unavailable in large numbers. As a result, rolling stock was still due when the armistice period ended. Because equipment was owed, the deficit was cited in the Protocol of 10 January 1920 where the Germans pledged a continuance of the delivery. Most of the stock was received, for the Reparation Commission credited Germany with 4,983.226 locomotives and 148,039.14 cars in accordance with Article 250 of the Treaty of Versailles. Not all of these went to France and

Belgium, as Poland, Roumania, Czechoslovakia, and Lithuania purchased some from France. Although neither France nor Belgium emerged with more equipment than before the war, they did receive stock which was bigger and some which yielded years of service. The Germans were not long handicapped. By 1925 they had more equipment than in 1913.

In spite of outward appearances the quotas were just and fair, and the delivery was relatively free of rancour and vindictiveness. The German economy had not been ruined from the combination of the continuing blockade and the loss of the rolling stock, as some Germans feared when they read the Armistice terms. 383 pages. $4.90.

THE NEW YORK WORKINGMEN AND JACKSONIAN DEMOCRACY, 1829-1837

(L. C. Card No. Mic 58-2464)

Walter Edward Hugins, Ph.D.
Columbia University, 1958

The political developments in New York City from 1829 to 1837 were significant manifestations of the popular ferment associated with Jacksonian Democracy. The Workingmen's Party was surprisingly successful in the 1829 election and, even though soon divided by factionalism, survived for two years. Following a brief hiatus, during which journeymen's associations multiplied and a formidable city central trades' union was organized, the Workingmen reentered politics and formed an alliance with the Democracy to aid in Jackson's struggle with the "Monster" Bank. This contest against monopoly, translated to the local scene, led to the Locofoco secession, in which the Workingmen in a new guise renewed their demand for "equal rights" and a reform of the state banking system. Reunion with Tammany came in 1837, after two years of independent political action; although the Workingmen were absorbed into the Democratic Party, the impress of the movement remained evident throughout the next decade.

While the Workingmen undeniably belong on the left of the Jacksonian political spectrum, neither the socio-economic roots of this movement nor its vision of the "new society" falls easily into a clear pattern of proletarian protest. A three-fold analysis, approaching the Workingmen through the aspects of the party, the personnel and the program, reveals that the movement was not restricted to journeymen or wage earners, nor was it a political manifestation of the contemporaneous labor movement. Investigating the Workingmen as a group of individuals, on the basis of newspaper accounts of party meetings, this study includes a survey of 850 men active in the movement. Data contributing to a life history of some of them are available in biographical encyclopedias, from which significant conclusions can be drawn regarding the socio-economic basis of the movement. This has been supplemented by an occupational tabulation of the entire group, 700 of whom have been identified from city directories and other sources. This analysis of life histories and occupations has then been related to the program proposed by the Workingmen in an effort to discover both the roots and the concrete objectives of their radicalism. A statistical analysis of the source of its electoral support, in comparison with the vote for the major parties, sheds further light on the class basis of the movement, as well as its contribution to the evolution of the Democratic Party in New York.

This examination of the New York Workingmen's movement reveals it to have been essentially middle class in membership, interests and objectives, even though it drew much of its support from wage earners. The diversity in the life histories and occupational groups takes form only with reference to the specific issues in the party program. Each significant occupation represented in the movement had a specific economic grievance: lien law, anti-auction, prison labor, licensing system, "medical monopoly." Moreover, large segments of the middle class could agree on such social and political demands as public education, repeal of imprisonment for debt, and judicial and electoral reform. All these issues could be agitated in terms of the demand for "equal rights" through the abolition of the monopoly system, the banks serving as a familiar and convenient scapegoat for their real or imagined distress. So aversion to banking is no more the key to the Locofocos than is faith in education to its precursor, the Workingmen's Party. Though often stating their demands in radical language, these mechanics and small businessmen were expressing, not a proletarian animosity to the existing order, but the demand for equal opportunity to become capitalists themselves. Despite the diversity of their specific grievances, these men were united in their desire to eliminate or hedge law-created privilege in an effort to further the democratization of capitalist society.

329 pages. $4.25.

SOVIET MARXISM AND THE PHILOSOPHY OF NATURAL SCIENCE, 1922-1929: THE REJECTION OF POSITIVISM

(L. C. Card No. Mic 58-2466)

David Joravsky, Ph.D.
Columbia University, 1958

Marx, Engels, Plekhanov, and Lenin, whose writings were the "classics" of Soviet Marxists in the period under review, left a philosophical heritage that could be interpreted either metaphysically or positivistically. Except for a brief essay by Lenin in 1922 and a briefer declaration by the Twelfth Party Congress in 1923 that Soviet Marxist thought must go "beyond the boundaries of social science," the highest officials and organs of the Soviet Communist Party issued no public directives concerning philosophy during the 'twenties. This silence, and the ambiguous philosophical heritage, set the stage for controversy. The controversy that ensued centered about the philosophy of natural science, for it was precipitated and sustained not by the political dissensions within the Party -- they had little or no connection with the philosophical controversy -- but by the effort to raise a new generation of "red specialists." The job of providing a suitable ideology for such "red specialists" split Soviet Marxists into two philosophical factions.

The mechanist faction interpreted the Marxist philosophical heritage positivistically by stressing reduction as the chief method of cognition and science: dialectical

materialism was declared to be a universal philosophy but was at the same time reduced to the generalized findings of the specific sciences. Though the mechanists were a rather heterogeneous group of propagandists, philosophers, and natural scientists, they were agreed that the Marxist philosophy of natural science must consist of empirically verifiable statements. Practically, they seem to have been most concerned with fashioning an ideology that would win mature scientists (the "bourgeois" specialists) to Marxism. The Deborinites, on the other hand, were a fairly homogeneous faction, consisting mostly of "Deborin and his students," who looked to Hegel as the chief source of the Marxist philosophy of natural science, and stressed the existence of irreducible levels of integration, at the summit of which they placed materialist dialectics. Practically, their appeal was not so much to mature natural scientists as to graduate students of Communist sympathies.

From 1924-1925, when the controversy broke out, it was clear that the predominant trend of Party thought favored the Deborinites. The mechanists could not shake off the accusation that they were justifying the "bourgeois" scientist's resistance to "the penetration of dialectical materialism in natural science." In 1929, as the Party began to press for rapid industrialization and collectivisation, it pressed also for a rapid "scientific changeover," that is, for a rapid replacement of "bourgeois" by "red specialists," and the philosophical controversy was terminated. A Conference of Marxist-Leninist Research Institutions in April, 1929 formally condemned the mechanist position and endorsed the Deborinite. But the highest Party organs and officials still maintained their silence, perhaps because many questions remained unresolved. In particular, authority had not been unequivocally located whether in a philosophical of in an institutional sense. Hegel's philosophy had been enthroned as the chief source for the philosophy of natural science, but at the same time "practice" was declared to be the ultimate criterion of truth. "Deborin and his students" seemed to have been established as the official interpreters of Marxist philosophy, but nearly all of them agreed with Stalin that the Central Committee was the "areopagus" for Communists in all fields. The stage was set for a new controversy.

480 pages. $6.10.

THE LEAGUE OF AMERICAN WHEELMEN AND THE GOOD-ROADS MOVEMENT, 1880-1905

(L. C. Card No. Mic 58-1191)

Philip Parker Mason, Ph.D.
University of Michigan, 1957

The purpose of this study is to trace the progress of the good-roads movement in the United States from its beginnings during the last half of the nineteenth century up to the year 1905, and specifically to determine the role of the League of American Wheelmen and other forces in the campaign for road reform during this period.

The first part of the study is devoted to the formation of the League of American Wheelmen and the agitation for a wheelmen-sponsored good-roads movement. In the discussion of the formal campaign of the wheelmen, special attention is given to their program to educate the American people to the advantages and need for road improvement and to their activities in the preparation and distribution of information regarding the proper methods of road construction and maintenance. The role of the League of American Wheelmen in the campaign for federal aid, as well as its good-roads activities on the state and local level, is also considered in detail.

Particular emphasis has been placed upon the establishment of the Office of Road Inquiry in the Department of Agriculture in 1893 and the work of that federal road office in the years prior to 1906. The important work of the League of American Wheelmen in the legislative battle for the creation of a national highway commission is demonstrated as is the League's close cooperation with the Office of Road Inquiry in the decade after 1893.

In addition to an account of the work of the League of American Wheelmen and the Office of Road Inquiry in the good-roads movement, attention is given in this study to other forces active in the campaign, including professional engineers and the manufacturers of carriages, bicycles, automobiles, and road machinery. The role of farm organizations in the movement is emphasized because of their strong opposition to road reform. Rural free mail delivery is shown to have been an important force in the campaign for better roads.

The third part of the study is concerned with the progress of the good-roads campaign up to 1906. The extent and type of state-aid programs, as well as the reforms in highway administration on the local level, are treated in a general way. Included in the latter category are the reforms associated with the centralization of highway administration, and employment of skilled personnel in road building, and changes in methods of road taxation. An attempt has also been made to show the progress of road construction by 1905.

Several conclusions can be drawn from the study. The good-roads movement prior to 1906 was an extremely important episode in the development of the American highway system. It was during the period before 1906 that the essential groundwork was laid for a system of road administration capable of adaptation to the needs of the automobile age. The League of American Wheelmen was the most active force in the early campaign for better roads and deserves a major share of the credit for the establishment of state aid to roads in a majority of those states which had adopted such programs by 1905. Moreover, the wheelmen were instrumental in securing the widespread reforms of local systems of road administration during this period.

282 pages. $3.65.

THE FUR TRADE OF NEW ENGLAND IN THE SEVENTEENTH CENTURY

(L. C. Card No. Mic 58-1867)

William I. Roberts, III, Ph.D.
University of Pennsylvania, 1958

Supervisor: Leonidas Dodson

Fur was among the first of New England's products to attract the attention of English merchants and speculators. The early reconnaissance voyages of Gosnold, Weymouth

and Pring revealed a lucrative fur trade in New England, developed by French fishermen while England was still undergoing essential preliminaries to colonization. However, the discouraging results of the Sagadahoc enterprise, the growing hostility of the Indians, and a devastating plague prevented the growth of the fur trade until the 1620's. The establishment of permanent settlements in New England was essential to the success of the fur trade because English promoters failed to comprehend the sophisticated Indian tastes in trade goods and the true financial requirements of the fur trade. The experience of the Pilgrims, whose colony was essentially a fur trading post, are a case in point. Despite the Plymouth experience, English misconceptions regarding the fur trade persisted, as the plans of the Massachusetts Bay Company, the Laconia Company, the Nova Scotia Company, and other gentlemen ventures in the fur trade demonstrate.

The rise of Boston as the commercial center of New England made the merchants of that port the leading figures in the fur trade. These men valued fur less as a source of gain than as a means of transmitting payments to their London creditors. The fur trade becomes especially important to them in the 1640's, when the cessation of immigration cut off the influx of cash which previously had served to redress trade balances in London. The increased demand for furs, which could not be satisfied by New England's meager resources, provided the impetus for attempts to tap sources in French Acadia, New Netherland, and on the Delaware. These ventures proved highly dramatic affairs, and complicated New England's relations with her neighbors.

The only lasting success the merchants encountered in these ventures was in developing a trade for furs with New Netherland, principally in exchange for New England foodstuffs. This trade became vital to the Dutch and provided a continuing supply of furs for the Puritan merchants. In the meantime, however, the pressure to find furs was partially relieved by growth of trade with the West Indies. Thereafter new ventures in the fur trade became more speculative in nature.

In 1654 Robert Sedgewick's conquest of Acadia provided another source of furs for the merchants. Acadia remained in English hands until 1670, as a proprietary colony under Sir Thomas Temple, an English gentlemen who monopolized the fur trade and marketed his furs in Boston.

Although the Puritan merchants momentarily regained the Acadian fur trade, when the Dutch conquered the country, their chief source of furs after 1670 was in trade with New York. The fur trade between Boston and New York steadily diminished after this date because direct trade between New England and the mother country declined. The development of trade between New England and France, Ireland and Scotland reduced the volume of exchanges with the mother country, and therefore the demand for furs. Simultaneously, the New York merchants, whose overseas trade had previously been small, found outlets abroad for the furs which they had previously traded to New England. In the decade following King Phillip's War the fur trade ceased to be significant in the New England economy.

290 pages. $3.75.

THE RIGHT OF SECESSION IN THE DEVELOPMENT OF THE BRITISH COMMONWEALTH OF NATIONS

(L. C. Card No. Mic 58-2477)

Ridgway Foulks Shinn, Jr., Ph.D.
Columbia University, 1958

This book has for its main theme the development of the right of secession during the twentieth century as an important influence on change in the British Empire. The question of secession had arisen earlier in the British Empire, especially in the eighteenth century when the American colonists had argued for secession as a natural right. In the twentieth century, the right of secession became an important concern of two dominions: the Union of South Africa and the Irish Free State. Because Canadian leaders were also interested in some explicit definition of dominion status, the Imperial Conference of 1926 adopted the famous "Balfour statement" which declared that the dominions were "freely associated as members of the British Commonwealth of Nations." The precise meaning of this phrase was not clear.

To clarify the implications of this statement, subsequent conferences and committees met. The result of their work was the Statute of Westminster, 1931, which made dominion parliaments legally equal to the Imperial Parliament by permitting them to repeal imperial legislation as it affected domestic law. But the question whether the Statute of Westminster also included the legal right to secede remained unanswered. During debates in the Irish and South African parliaments on the work of the Imperial Conferences and on the draft of the Statute of Westminster, Government leaders claimed that the right to secede now existed and that, therefore, those dominions had achieved full autonomy. Leaders in the Australian and New Zealand parliaments expressed opposite views and deplored the weakened imperial connection. As a result, they did not request application of the Statute of Westminster until in the 1940's. Canadians were more concerned with other phases of dominion status, especially the power of the governor-general. For British leaders, the theoretical supremacy of the Imperial Parliament still remained because the Statute of Westminster was an act of the Imperial Parliament. However, two minority groups questioned this position: the group of Conservatives led by Mr. Churchill and the Labour Party. Both of these groups understood that dominions possessed the right to secede.

During the 1930's, Governments in Ireland and South Africa enacted legislation based on their interpretation of dominion status. The Status of the Union Act, 1934, made the Crown divisible by specifying that the King would become King of South Africa through action of the South African parliament. The Irish, under Mr. De Valera's leadership, abolished the oath to the King. The British Government maintained that the Irish parliament had exceeded its powers. However, the decision in Moore's case, 1935, reversed the British position because it stated that, under the Statute of Westminster, the Irish parliament could legally abolish the oath. If it had power to do this, than Ireland could legally secede. There was some question whether Ireland did not, in fact, secede in 1937 when a republican constitution was enacted. In any event, by the time war commenced in 1939, the right of secession existed. Irish and South African leadership, together with Canadian help and, indeed, British acquiescence had

changed the British Empire to the British Commonwealth of Nations.

Therefore, when Britain faced, during the 1940's, Indian demands for independence, she could offer dominion status. Dominion status was ultimately acceptable to nationalists in India as well as Pakistan, Ceylon, Ghana, and Malaya, because the right to secede had been established. In fact, the secession of Burma in 1948 and of Ireland in 1949 was positive proof that the Commonwealth of Nations was a voluntary association of autonomous countries. The right to secede had been one of the dynamic elements by which this change occurred. 288 pages. $3.70.

THE NEGRO ARTISAN IN THE SOUTH ATLANTIC STATES, 1800-1860: A STUDY OF STATUS AND ECONOMIC OPPORTUNITY WITH SPECIAL REFERENCE TO CHARLESTON

(L. C. Card No. Mic 58-2246)

Leonard Price Stavisky, Ph.D.
Columbia University, 1958

Intent upon improving his status, the Negro has "left" the farm and "entered" the factory. This conventional interpretation oversimplifies the historic development of Negro labor in America. The movement from farm to factory, which is still going on, has not been confined to the recent past. Even during the days of slavery, the Negro labored in many fields, both skilled and unskilled, both agricultural and non-agricultural.

Prior to the Civil War, the lower South failed to realize its industrial potential. Tradition and environment delayed the growth of manufacturing. Citing the enormous investment in land and slaves, many planters rejected the promise of industry, questioned the ability of the Negro and discouraged attempts to diversify the economy. All other forms of business activity became the handmaidens of agriculture.

Thus it was not surprising to find Negro field hands who doubled as artisans, or white mechanics who owned rural plantations. The crafts reflected this trend. They were geared to the needs of an agricultural society, providing carpenters to build plantation houses, coopers to turn out barrels for storing the crop, spinners and weavers to convert the raw materials into finished cloth, and blacksmiths to fashion the tools. Here was a virtual reincarnation of the medieval manor with its avowed goal of economic self-sufficiency.

Intelligent slaves were instructed in the crafts. These mechanics were worth considerably more than unskilled slaves. Such training often led to hiring out privileges, freedom of movement, absence of supervision and opportunities to work for wages. Contacts with free persons sometimes made these Negroes restive and dissatisfied with slavery. Attempts to restore discipline or invoke the power of the law usually resulted in unrest among the artisans. Many runaways and participants in slave revolts had been trained in the crafts, for the same qualities of intellect and ingenuity which enabled them to master the trades were readily applied to various forms of resistance.

Negro craftsmanship differed in town and country. Rural crafts reflected immediate plantation needs. In the cities, there was greater economic diversification, ranging from the artistic handicrafts to certain heavy industries. Whereas the plantation artisan produced for home consumption, the Negro employed in an urban shop created goods for the general public. Each planter was likely to own a heterogeneous group of skilled and unskilled slaves, but the urban master needed a homogeneous corps of Negroes who were proficient in identical or related trades.

There were other regional differences. Very early in the nineteenth century, the industrial standing of portions of the lower South was comparable to that of New England and almost as good as in some of the border communities, a status that was lost by the end of the ante-bellum era. A study of 18 industries in the City of Charleston between the years 1826 and 1848 discloses a decline in personnel in 15 fields, at the same time that the upper South and northeastern seaboard were undergoing considerable industrial expansion. This de-emphasis was caused by an abandonment of the trades by white labor and the increasing inroads of plantation slavery.

Approximately 80% to 90% of Charleston's crafts were entrusted to Negro labor. In the upper South, dependence upon Negro artisans was somewhat less. An estimated 100,000 of the 120,000 Southern artisans at the conclusion of the Civil War were Negroes.

This corps of Negro artisans wielded an influence in the slave system far beyond their numbers. They contributed to the Southern economy; they assumed positions of leadership in the ranks of their race, and their presence tended to drive a divisive wedge between the planters and poor white mechanics whom they frequently supplanted. Competition sowed the seeds of racial conflict, creating understandable antagonisms which have persisted even to this day. 295 pages. $3.80.

THE INFORMAL EVALUATION AS A TEACHING TECHNIQUE FOR SOME OF THE LESS TANGIBLE ASPECTS OF A HOMEMAKING PROGRAM AT THE SEVENTH AND EIGHTH GRADE LEVELS

(L. C. Card No. Mic 58-2278)

Helen L. Cawley, Ed.D.
The Pennsylvania State University, 1958

This study was concerned with the development, refinement and use of informal evaluation devices and techniques as teaching techniques in some of the less tangible aspects of a homemaking program at the seventh and eighth grade levels in two Buffalo city schools.

Goals considered less tangible by the homemaking teachers are listed below according to teacher preference:

1. To learn to work well with my classmates and teachers.
2. To be friendly with people of different ages.
3. To learn to respect property and rights of others.
4. To take better care of my own things at home and at school.
5. To try to remember that you cannot judge an action or a thing by its cost.
6. To learn to get along well with little children.
7. To learn what a girl my age should do and what she should not try to do in taking care of children.
8. To develop self-confidence in taking care of children.
9. To try to do whatever I am doing as well as I can.
10. To learn to spend the money I have so I will get the most from it.
11. To try to learn what goes into a friendship.

Nineteen informal evaluation devices were developed in terms of these goals or their sub-goals. The devices were checked by a group of educators to establish their validity and reliability; in doubtful cases they were presented to pupils not in the study for their reactions and suggestions.

Seventeen of the informal evaluation devices were used by two seventh grade and two eighth grade sections at Schools #19 and #82. One hundred and twenty-two girls participated; however, not all of the instruments were used by the entire group. The regular homemaking teachers and twenty-three junior participants from the Home Economics Division, College For Teachers, Buffalo, were also involved in this study.

Determination of the effectiveness of the instruments was based on statements made to the investigator by a sampling of pupils, through observation, and the opinions of the participating teachers.

The instruments developed in the areas of personal, family and social relations were apparently the most effective teaching techniques used with pupils in this study. However, the instruments developed in the area of child development also rated highly as effective teaching techniques.

The characteristics which made these devices and techniques seem more effective than the others in terms of teacher and pupil judgment were:

1. The goals seemed more important and realistic to the pupils than some of the other goals.
2. The devices were better suited to the age and development of the pupils than the less popular devices.

In a study of this type there could be no measurement of improvement as exact as would be possible with tangible goals. However, there was evaluation in terms of each instrument. In general, the study goes further than teachers usually go in evaluating the intangibles.

Generally, the teachers, junior participants from the college and the pupils reacted favorably to all the devices.

This study indicates that:

1. A variety of meaningful informal evaluation instruments can be planned cooperatively and used as teaching techniques in some of the less tangible aspects of a seventh and eighth grade homemaking program.
2. Seventh and eighth grade homemaking teachers in the schools may be assisted in presenting some of the less tangible aspects of a homemaking program through the development and use of informal evaluation.
3. Informal evaluation instruments may be developed and used as teaching techniques in conjunction with the pre-service and in-service programs in home economics education at the seventh and eighth grade levels. 174 pages. $2.30.

SATISFACTIONS AND DISSATISFACTIONS OF COLLEGE TEACHERS OF HOME ECONOMICS

(L. C. Card No. Mic 58-2279)

Eva Lanice Moore, Ph.D.
The Pennsylvania State University, 1958

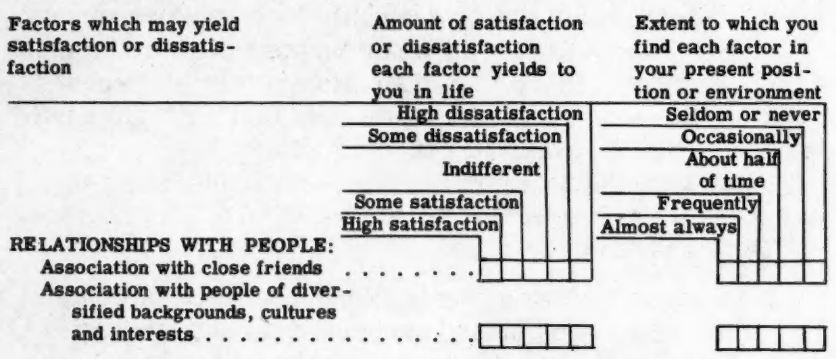
This investigation was a study to determine the factors which affect the satisfaction and dissatisfaction of teachers of home economics at the college level. The hypothesis which the investigator tested was: Job satisfaction is determined to a considerable extent by the presence or absence of factors which yield satisfaction or dissatisfaction in life. It was an attempt to measure more of the intangible factors related to job satisfaction than have been measured heretofore.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Summary of Procedure

The approach to the study considered satisfaction with the position as a "whole" and then compared the relationship of the various aspects to this "whole."

A questionnaire was prepared using three methods for determining job satisfaction: Section A, a self-appraisal of the teacher's present job satisfaction; Section B, "Yes," "No," and "?" questions; and Section C, a rating of life satisfactions. Section C was developed by conducting broad open-end interviews to determine what factors would bring high satisfaction or high dissatisfaction in life. The responses were categorized and placed under four headings: relationships with people, intra-personal feelings, working conditions, and community and environmental conditions. The respondent was to check the seventy-eight factors indicating his feelings with respect to each. The form used for Section C with two illustrative statements follow:



Summary of the Findings

An analysis of the sampling showed a seventy-nine per cent response or that 348 usable questionnaires were received from faculty members teaching at least one class in 49 out of 61 degree-granting institutions in New York, Ohio, and Pennsylvania. Of the total individual responses, 34 per cent were from private, 49 per cent were from municipal or state, and 17 per cent were from church supported institutions.

Correlations obtained between the satisfaction scores of the three sections, .513, .636, and .629, were all highly significant at the one per cent level of confidence, indicating validity of the instrument. Reliability coefficients were: .94 for life satisfactions, .83 for the Yes - No questions, and .72 for the self-appraisal technique. Correlations between the over-all satisfaction score and each of the four groupings found within Section C were: .775, .859, .896 and .657.

The satisfaction scores indicated that faculty members were generally satisfied with their positions. None of the teachers were highly dissatisfied with their positions according to the life satisfaction scores. However, three per cent of the respondents evaluated themselves as dissatisfied according to the self-appraisal technique.

Six selected comparisons were made among the various groups participating in the study. These comparisons indicated that: Older teachers were more satisfied in relationships with people than younger teachers. Full professors were significantly more satisfied than instructors in the area of community and environmental conditions. Satisfaction scores consistently increased with each level of advanced education and with higher salaries. The size of the community and the institution did not make any significant difference in satisfaction scores.

The hypothesis of the study was proven to be true: that job satisfaction is determined to a considerable extent by the presence or absence of factors which yield satisfaction or dissatisfaction in life.

Recommendations are given in the study for possible uses of this instrument, adaptations of the technique developed for the instrument, and suggestions for additional research. 165 pages. $2.20

JOURNALISM

TWENTY YEARS OF LIFE: A STUDY OF TIME, INC.'S PICTURE MAGAZINE AND ITS CONTRIBUTIONS TO PHOTOJOURNALISM

(L. C. Card No. Mic 58-2357)

Otha Cleo Spencer, Ph.D.
University of Missouri, 1958

Supervisor: Frank Luther Mott

For nearly eighty years the photograph has been a part of journalism. Since the New York Daily Graphic published the first halftone, on March 4, 1880, editors and publishers have had a new tool of communication--a tool which promised to be much more powerful and expressive than the words they had been using for hundreds of years. In the early days of the halftone a few magazines and newspapers adopted photography, but the profession of journalism as a whole accepted the photograph only as a means of illustration or as a new method to vary typographical make-up.

This study makes a distinction in the definition of certain terms used in journalism. These are: "Pictorial Journalism" "Photojournalism," and "Photojournalism." The study explores the basic philosophy behind each and labels "Photojournalism" as the latest development in reporting.

Twenty Years of Life outlines the expansion and evolution of photography into the field now identified as photojournalism and attempts to show the tremendous importance of the photograph to journalism. This has been done through the story of the highly successful magazine Life, the first publication to base its editing philosophy on the use of photographs as the primary means of conveying information and reporting news. This new approach to journalism makes Life a unique and valuable contributor to the field of mass communications, and establishes its contributions as the beginning of a new era in journalism.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

The study also attempts to show that the picture, made by a skilled photo reporter, is now ready to take its place on the same level with the printed word, written by an equally skilled word reporter. The final thesis of this study is that the melding of these two skills--photography and writing--has produced a result which is greater than the sum of its component parts. This result is photojournalism.

In addition to the mere physical act of taking a picture and printing it on paper, there is a tremendous amount of philosophy and psychology tied up in the problem of bridging the gap between an event, or an idea, and the mind of the reader. These inner processes are outlined in the elaborate planning that went into Life.

The use of photographs in journalism is not enough to gain the spectacular results achieved by Life and the other successful picture publications. New concepts of editing must be used, and the publication must support a photographic team in a manner beyond normal practices in journalism today. Editors must learn to "think" in pictures and form the completed story presentation around pictures with a minimum of words. Full support of a photographic team means that the publication must provide the situations which will allow the photographer to exercise his full abilities as a camera reporter. Following this formula, in its complexities, any publication can gain the huge benefits offered by photojournalism.

Life has grown into one of the world's most successful magazines, with a weekly circulation in excess of seven million copies. This has been done through the skilled use of photographs to report the events of the world. Life heralds photojournalism as a new type of reporting and a new concept of mass communications. 501 pages. $6.40.

LANGUAGE AND LITERATURE

LANGUAGE AND LITERATURE, GENERAL

THE LETTERS OF GEORGE MOORE TO EDMUND GOSSE, W. B. YEATS, R. I. BEST, MISS NANCY CUNARD, AND MRS. MARY HUTCHINSON

(L. C. Card No. Mic 58-2207)

Charles Joseph Burkhart, Ph.D.
University of Maryland, 1958

Supervisor: Associate Professor Franklin D. Cooley

The thesis is a critical edition of 5 groups of George Moore's correspondence, and includes 170 letters to Edmund Gosse, 14 letters to W. B. Yeats, 39 letters to R. I. Best, 20 letters to Miss Nancy Cunard, and 59 letters to Mrs. Mary Hutchinson. These 302 letters, which date from 1890 to 1933, have been collected from a variety of institutional and private sources, including the Brotherton Collection, Brotherton Library, University of Leeds; the National Library of Ireland, Dublin; Duke University Library, Durham, North Carolina; the Henry W. and Albert A. Berg Collection of the New York Public Library; and Mrs. W. B. Yeats, Mrs. Mary Hutchinson, Miss Nancy Cunard, Mr. Frank H. Fayant, and Dr. Ulrich Middeldorf. All letters have been reproduced with the permission of their legal owners and of the literary executor of George Moore, Mr. C. D. Medley. In addition to the letters, the thesis includes a Preface concerning the provenance and methods of editing the letters and an Introduction which is a discussion of and guide to the letters.

The five groups of letters have been selected for their value in showing different sides of Moore as man and artist. The letters to Gosse, the longest group, are particularly valuable in showing Moore as a literary theorist and critic. The letters to Yeats are an intimate picture of the Irish Literary Theatre and of the play on which Moore and Yeats collaborated, Diarmuid and Grania. In the letters to Best, the methods of Moore in his late novels and the degree to which he depended on his scholarly friends for aid in the composition of his books are shown in detail. The letters to Miss Cunard reveal Moore's most deeply considered views on art and the nature of the artist. Last, the letters to Mrs. Hutchinson give a picture of Moore's social life in his later years. The recipients of the letters are of interest in the world of literature in every case.

Much specific information is given on the details of Moore's writing career, and there is full discussion of almost every work written between 1900 and 1933. Moore's opinions on religion, art, his own works, and the works of other writers past and present are stated with candor and force. He is shown in the unfamiliar roles of dramatist and poet as well as in his more familiar roles of novelist and critic. The spontaneous and artless epistolary style of Moore is in striking contrast to the highly worked and artful style of his late novels. From his letters Moore emerges as a man of complex and rare personality and as a writer totally dedicated to his craft. 436 pages. $5.55.

THE LITERARY EMANCIPATION OF A REGION: THE CHANGING IMAGE OF THE AMERICAN WEST IN FICTION

(L. C. Card No. Mic 58-2360)

Francis Edward Hodgins, Jr., Ph.D.
Michigan State University, 1957

In our past, no region has had greater impact on the American mind and mythology than the Far West. The West, so long a land unknown to most Americans, has been the loveliest of all our myths, a lure which drew men beyond the next meridian for centuries. Yet in the hundred years after Lewis and Clark stretched the map to the Pacific and the West became a force in American experience, it found no meaningful expression in American literature.

More than the common delay between historical experience and its use in fiction was involved. The West possessed in the American consciousness a geography of fantasy engendered by desire working in the vacuum of ignorance. Behind early fiction of the region, as Henry Nash Smith has shown in Virgin Land, can be discerned two contrasting images of a land shrouded from the first in mystery and misconception.

One image, the agrarian, derived from the physiocratic thought of the eighteenth century and envisioned an agrarian utopia to be established beyond the frontier, a vast Garden of the World occupied by contented freeholders tilling their fruitful acres. Clustered about this image were virtues that gave it imaginative force: independence, self-subsistence, political stability, wisdom drawn from contact with the soil. Historically, this image found issue in the surge of an agricultural population across the continent and reached political fulfillment in the Homestead Act.

The second image, the image of empire, envisioned a limitless and untamed wilderness inhabited by lonely anarchs. Certain values attached to this image also: escape from society, self-reliance in a perilous environment, fortune, adventure, and above all freedom. Translated into economic terms this image found issue in the reckless exploitation of the fur trade, mining boom, and early cattle kingdom.

Neither image adequately described reality in the West, but together they shaped American thinking about the region. Because literature of the nineteenth century was generally dominated by the genteel tradition, which did not accord high place to agrarian values, fiction of the West, in general, followed the empire image.

Cooper was among the first to use the land beyond the frontier extensively in fiction, and the Leatherstocking novels, prevented from adequately exploring the tension between civilization and the wilderness (their major theme) by the intellectual inconsistencies involved in joining genteel conventions with the empire image of the West, established conventions and stereotypes that, debased by the dime novelists, became the formula that has characterized the "Western" down to the present.

For fiction to escape this sterile tradition, it would be necessary to see the West in new perspective. Inadvertent breaks in the pattern appeared even in the formula-ridden novels of Mayne Reid, and more clearly in the honest, if elemental, social history that Andy Adams tried to transform into fiction. Nevertheless, at the turn of the century Owen Wister, though he did better things elsewhere, reimposed the old artistic and intellectual assumptions upon the West in The Virginian. Eugene Rhodes's indiscriminate egalitarianism and opposition to formula marked a definite advance, but the basis of emancipation became unmistakably clear with Bernard DeVoto's early Western novels. Though in many respects they fail artistically, they mark the end of the old images of the West in serious fiction.

Since the 1920's the image of the West in fiction has changed rapidly. In the pages of Edwin Corle, Harvey Fergusson, Harold Davis, A. B. Guthrie, Jr., and Walter Van Tilburg Clark American experience in the West has assumed an importance for literature it never had before.

590 pages. $7.50.

THE DARK NIGHT OF SAMUEL TAYLOR COLERIDGE

(L. C. Card No. Mic 58-2247)

Marshall Edward Suther, Jr., Ph.D.
Columbia University, 1958

This study deals with the question of what happened to Coleridge, with special reference to his poetic career. Although he was recognized as one of the great minds of his time, he failed in some significant way in every major department of his life, as husband and lover, as philosopher, and as poet. Although he produced several of the greatest poems in the language by the time he was twenty-five, he never produced another of such quality, and he became virtually incapable of the poetic experience. The contention here is that Coleridge can best be understood by considering his problem as basically religious, and by viewing him in juxtaposition with the Continental romantics rather than his English contemporaries.

Before analyzing the problem in this way, the view that Coleridge was a poet spoiled by metaphysical pursuits is examined. It is shown that, as this position is stated by various commentators including Coleridge, it leads to serious confusion of the problem, because of its tacit assumption that one is "born" poet or metaphysician. To avoid this difficulty, the ascertainable facts concerning Coleridge's poetic and philosophical preoccupations are reviewed, and the conclusion is reached that whatever spoiled him as a poet, it was not metaphysics.

In Chapter II, the role of love in Coleridge's life is examined in relation to his poetic career, first by reviewing his statements concerning it, then by examining his early experiences, family relationships, love for Mary Evans, and unsuccessful marriage to Sara Fricker. Certain recurrent themes in his poetry, and his statements concerning the great love of his life, for Sara Hutchinson, lead to the conclusion that from the beginning Coleridge placed on the experience of human love an intolerable religious burden, a fact which accounts in large part for his failures therein, and is closely analogous to his expectations of the poetic experience. But it cannot be said that his virtual renunciation of poetry was due to emotional tribulations.

There follows a detailed analysis of "Dejection: An Ode." First, in Chapter III, the use of certain symbols in the poem which relate to the poetic experience is traced in previous poems, to make clear the significance of their use in "Dejection," and to show the stages Coleridge passed through in his expectations of the poetic experience. In Chapter IV "Dejection" itself is analyzed. The significance of the epigraph from "Sir Patrick Spence" is examined, then the description of his state of mind in Stanzas II and III, his analysis of its cause in autobiographical terms in Stanza VI, and his philosophical rationalization thereof in Stanzas IV and V. The question as to whether the poem reflects a "projective" or a "realist" view of the poetic experience is posed, the statement of "Dejection" is compared with earlier statements concerning the poetic experience, and the conclusion is reached that "Dejection" adopts a thoroughly "projective" view and thus constitutes a recantation of his early faith in the poetic experience, resulting from the frustration of his mystical expectations of it.

In Chapter V, the peculiar importance of the

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

autobiographical element in romantic poetry is discussed and taken as an indication of the romantics' extra-artistic use of the poetic experience, isolated for the first time from its normal issue in artistic elaboration. A detailed analysis of the poetic experience is undertaken, according to a critical theory similar to that developed by Jacques Maritain. Coleridge's case is then examined in terms of his original mystical aspirations, his philosophical rationalizations thereof, and his discovery of the limitations of the poetic experience, and the resulting échec. Coleridge's career is then compared in detail to that of Rimbaud, with passing reference to other Continental writers.

278 pages. $3.60.

MALORY IN THE NINETEENTH CENTURY

(L. C. Card No. Mic 58-2225)

Beatrice June Thearle, Ph.D.
University of Maryland, 1958

Supervisor: Associate Professor Franklin D. Cooley

The rediscovery of the works of Sir Thomas Malory at the beginning of the nineteenth century set in motion a literary movement that flourished throughout the nineteenth century and well into the twentieth century. The enthusiasm of writers and scholars resulted in the publication of a number of new editions of the Morte Darthur and the composition of many original works based on Malory's treatment of the old legends. Arthurian literature enjoyed a prominance it had not had for over four hundred years.

The literary efforts of the various authors of this period usually took the form of narrative poetry. Prose was used very little; and the drama was not attempted until the last decade of the century, although William Morris tried some dramatic treatments in the form of the dramatic monologue and short pieces much earlier.

The literature written in the first decades of the century exhibited strong romantic tendencies, the result of the predominance of English romanticism at that time. In the Victorian period the treatment of the stories was a combination of romanticism and realism. Both the Romantics and the Victorian periods showed a definite moral consciousness in regard to the stories. Most of the authors, with the exception of Morris whose attitude was similar to that of Malory, adopted the point of view that the love affair between Lancelot and Guinevere was sinful; and they used it to point a moral for their age.

The most important alterations in the material which the nineteenth-century authors took from Malory were those made in the portrayal of the characters. Lancelot gained new prominence, often at the expense of King Arthur and the other figures in the accounts. There was an almost complete reversal in his character. After 1850 his love for Guinevere was made his one all-corrupting vice. King Arthur tended to lose stature. He was depicted as a foil for Lancelot; or as the symbol of virtue. Guinevere's role too was altered. The earlier writers frequently made an effort to exculpate her for her part in the love affair. Some later writers made her the protagonist in the action and debased her character. Morris alone accepted her, sin and all, and glorified her. Gawain's character, which had been undergoing a change for the worse since the Middle Ages, continued to deteriorate. Tristram was usually used to exemplify illicit or erotic love, but little change was made in Iseult. Galahad maintained his traditional character as the symbol of holiness. His illegitimate birth was either ignored or hinted at, but seldom treated openly. Little change was made in Merlin's character. Other characters taken from Malory who appeared in the various pieces generally fulfilled their traditional roles.

The nineteenth-century Arthurian revival cannot be considered merely a resurrection of the old stories told by Malory in the Morte Darthur. It was an important step in the development of Arthurian literature, a step that resulted from the enthusiastic interest in medievalism of its own age and that affected the age that followed.

217 pages. $2.85.

THE FATHER-FIGURE IN EIGHTEENTH CENTURY ENGLISH COMEDY

(L. C. Card No. Mic 58-2167)

George Thomas Vane, Ph.D.
University of Minnesota, 1958

Though essentially another stock figure in a drama filled with stock figures, the father not only appeared as an important character in the majority of eighteenth century comedies, but mirrored, to an extraordinary degree, the theory of comedy implicit in each play. By analyzing the ways in which the father-figure was portrayed, the plot situations in which he appeared, and the themes with which he was associated, one can trace some of the conventions of eighteenth century comedy as they were reflected in the delineation of character and make more clear what inroads the sentimental and exemplary approaches made upon satiric comedy from the beginning to the end of the century. Indeed, to trace the fortunes of the father in comedy is to trace the fortunes of comedy itself.

Limiting the range of characterization that had been fairly broad in Elizabethan and Jacobean comedy, the cynically satiric Restoration playwrights created and passed on to the eighteenth century a comic world in which there was a perennial conflict between old age and youth, a world dominated by airily superior young sophisticates who deliberately scorned, defied, and deceived their invariably avaricious, foolish, and tyrannical parents. And, as long as dramatists conceived of comedy as ridiculing man's foibles, the father was presented as the outsider, the antagonist, the object of derision whose absurd schemes to force his children into abhorrent marriages had to be circumvented by deception.

Even before the turn of the seventeenth century, however, certain forces were working to modify gradually this typical characterization and plot. Critical controversies over wit, poetic justice, laughter, and humour, the general movement for social reform, bitter theatrical rivalry, and the Collier stage controversy all contributed early to the presentation of a father who, if not an exemplary parent, was less patently tyrannical and foolish. Above all, after evolving the philosophy of

exemplary-sentimental comedy, Richard Steele in his The Conscious Lovers (1722) presented the model for future sentimental playwrights and a picture of the father as a discerning, worthy parent, the guide, philosopher, and friend to his children. If Steele did not revolutionize comedy or the picture of the father, his example, coupled with the influence of the Shaftesburyian conception of the innately good man and the declining force of the neo-classical rules, led dramatists in the 1730's gradually away from satiric comedy with its foolish fathers toward exemplary comedy with its worthy parents.

If the next two were sterile decades for comedy, by the 1760's the didactic approach, now buttressed by sentimentalism, became a vital force in theatrical history, and, though sentimental comedy never dominated the stage, most comedies, satiric as well as sentimental, presented fathers worthy of emulation, utilized less ofter the traditional comic plot based on deception, and tended more than ever to treat such themes as the reuniting of long-separated fathers and children, forgiving fathers reconciled with prodigal children, and fathers testing, rescuing or suffering for their children. Though, by the 1780's, the sincerely didactic comedy modulated its sentimentalism with laughter and an occasional comic father, that of the last few years of the century so concentrated on the erring father that one can glimpse the inception of the guilty, sick, or weak parent prominent in much succeeding literature. Moreover, the increasing vogue of such themes clearly proclaimed the popular acceptance of the sentimental-pathetic play and the demise of that satiric comedy which was not to be reanimated until Shaw mocked the prejudices, the mores, and the middle-class morality which the eighteenth century bequeathed to the nineteenth.

418 pages. $5.35.

THE IMAGERY OF LUDOVICO ARIOSTO IN ORLANDO FURIOSO

(L. C. Card No. Mic 58-1366)

Emma Brescia Warren, Ph.D.
Columbia University, 1957

The general subject of this study on Ariosto's Imagery is the examination of poetic techniques in the method of Ariosto. It is probable that anyone who has devoted himself with even passing attention to Orlando Furioso has been aware of this element, for it is one of the basic features of the author's work. However, this element has not been studied through a minute analysis of Ariosto's comparisons which, together with a variety of symbols, enhance the surface brilliance of the poem and extend and deepen its more profound implications.

The object of this study is to show the extent to which the basic comparison in Orlando Furioso is a true and necessary part of the meaning of the poem and not merely added by the author as a kind of decoration. It may be said that Ariosto's use of similes and metaphors, symbols and figures, is one of the elements that give the almost constant poetic effect found in the poem. Even in his most prosaic passages, Ariosto brings in interesting and significant symbols; and, when he is writing at his very peak of effectiveness, he heaps image upon image until the reader is dazzled by their beauty and almost bewildered by their wealth of meaning. It is then that the poem has the greatest impact upon the reader.

The question which we try to answer is: Co the poetic suggestions and lingering on detail of the comparisons and symbols have a truly active and functional place in the general scheme of Ariosto, or do they merely serve as decoration the loss of which would not impair the poem? Is it a question of technique or of vision?

We try to demonstrate that the comparisons serve not only as a poetic hieroglyph, but also to support the general idea of the poem. It will be shown in the thesis how these devices serve to uphold the themes, and that without them there could be only a flat statement of the author's conception. Besides, they serve to create a language for understanding between the author and the reader through which certain feelings and certain emotions, internal and suggestive can be communicated.

How does the poet make his intentions clear to us? We try to understand him through a study of his comparisons, through a systematic listing.[1] In this manner we can see the interests of the poet, the range of his knowledge, and realize the scope of his feelings.

In his work Ariosto has told us in metaphorical language that he will weave a web with many threads. In order to do this the author had to depend constantly on metaphor and simile and these, together with symbol, are really an integral part of his style and of his vision.

The purpose of this study will not only be an examination and redefinition of the general idea underlying the poem, as well as a discussion of the techniques of Ariosto's poetic comparisons in the light of previous investigations, but--more important--an analysis of the relationship of the main principles of poetic comparison to that general idea.

Finally, the thesis tries to show that Ariosto's method is an attempt to create an organic inter-relation among all parts of his work, but he does not depend on ordinary consecutive action or the chain of cause and effect to achieve this purpose. He depends a great deal on the succession and repetition of all his "themes." The use of comparisons is one device he employs to keep the reader aware of the subtle connection of one part of his poem with another and with the fundamental ideas. The comparisons are not merely a detail of composition for Ariosto, for he himself seems to define every piece of creation as based on a new metaphor, which in itself is a new reality.

309 pages. $4.00.

1. There is an Appendix in the thesis. This contains a tabulation of lines containing similes and metaphors. These are presented under the following headings: Nature (Birds), Human Behavior (Manners and Customs), Literature and Religion, Science (Medicine), Military, Art, House, Boats, Social Rank, Color, Music.

LANGUAGE AND LITERATURE, LINGUISTICS

ARMED FORCES LANGUAGE TRAINING IN PEACETIME (SINCE WORLD WAR II)

(L. C. Card No. Mic 58-2471)

Alfonse Ralph Miele, Ph.D.
Columbia University, 1958

The author states that the importance of the subject of this study stems from the impact of the World War II Army Specialized Training Program (ASTP) in languages on language teaching in American schools and colleges. In order to bring up-to-date the evolution of military language programs since World War II, the author has established a three-fold purpose for his dissertation: (1) to outline the growth and development of military foreign language programs; (2) to point out the essential characteristics of their objectives, methodology and evaluation procedures; (3) to draw conclusions and implications for language offerings in American schools and colleges.

Since literature on this subject does not exist in the libraries, the author traveled to the Army Language School in Monterey, California, the Language Division of the Naval Intelligence School in Washington, D.C., the United States Air Force Institute of Technology in Dayton, Ohio, the Air Force Russian Program at Syracuse University, the Air Force Chinese Program at Yale University, the Foreign Service Institute Language School in Arlington, Virginia. The author used the data found in the files and archives of these schools, testing these data by interviews and observations.

Chapter I of the study outlines the origin, operation and some of the effects of the World War II Army Specialized Training Program on foreign language teaching in the United States. The information contained in this chapter gives a background for better understanding the post-war military language programs and the direction which they have taken.

Chapters II, III and IV discuss respectively the Army, Navy and Air Force language programs. Both the Army and Navy programs had their beginnings in the World War II need for Japanese language specialists. Later, the need for specialists in all languages with which American military personnel came in contact caused the Army and Navy to expand their language teaching facilities by creating special schools to fill their requirements. The Air Force has depended heavily on civilian universities, working on a contract basis, to train Air Force enlisted men and officers in language specialties. The objectives of all of the programs are the same, namely: to impart a functional command of the foreign language and to inculcate in the student, insofar as is practicable, a sympathetic understanding of the people and culture of foreign lands. The methodology employed is the Intensive Method of language study in which the student is taught the basic grammatical patterns of the language by a linguistic scientist or experienced college language professor, and drills in these patterns under the guidance of native speakers of the foreign language. The evaluation procedures used to measure student achievement in his studies are comprehensive in nature treating his ability to understand, speak, read and write the foreign language in a variety of situations.

In Chapter V, the author states that his study of peacetime military language programs adds further support to the feeling that Americans must in increasing numbers be taught a functional command of foreign languages as a stepping stone toward better understanding foreign peoples and cultures. Furthermore, more languages should be taught in American schools and colleges to include Russian, Chinese, Arabic, the African languages and the languages of India.

Finally the author analyzes the "success" factors in armed forces language programs and suggests that they be applied to the training of language specialists in colleges and universities by the establishment of Intensive Language Centers. 153 pages. $2.05.

LANGUAGE AND LITERATURE, MODERN

THE HUMOR OF WILL ROGERS

(L. C. Card No. Mic 58-2348)

E. Paul Alworth, Ph.D.
University of Missouri, 1958

Supervisor: Leon T. Dickinson

This study attempts to relate Will Rogers to the tradition of crackerbox philosophers in American literature. Since his death in 1935, there has been no philosopher-humorist of his significance on a national scale, and the tradition, which stems from Jack Downing in 1832, seems to have come to an end. It is the purpose of this study to show: (1) the formative influences on Rogers as a humorist including his Indian background, his frontier environment, his early stage career, his wife's influence, and his reading; (2) his observations on the social and political events of the Twenties and Thirties as expressed in his columns and lectures; (3) an analysis of his humor in terms of the techniques which he employed; and (4) the relationship of Rogers to other crackerbox philosophers before him, including Jack Downing, James Russell Lowell, Artemus Ward, Mark Twain, Finley Peter Dunne et al.
159 pages. $2.10.

ANDRE GIDE AND THE COMMUNIST TEMPTATION

(L. C. Card No. Mic 58-2457)

George Israel Brachfeld, Ph.D.
Columbia University, 1958

This study is an attempt at understanding the reasons and analyzing the nature of Gide's temporary endorsement of Communism.

The method pursued is as follows: Biographical data are first examined to determine how André Gide's family background, childhood, education and religion affected his attitudes on the social question. The social consequences of the young man's sexual deviation are then considered. Next, the writer's fictional works are examined for a

possible social interpretation. A history of the adult's activities of a social or para-social nature before the Communist experience is then presented. From the symbolic message of the mythological works an attempt is made to outline Gide's humanistic system. The attitudes of the humanist during and after the Communist interlude point to a conclusion about the faithfulness of his thinking on social matters.

The results of this investigation disclose that the first indications of the writer's social attitude are contained in his revolt against the limitations of his past. Thus he rejected family, dogmatic religion and repressive morality to evolve an ethical code founded on sincerity. A crucial determinant in his assertion of a right to authenticity was his sexual deviation, which made of him an outcast henceforth sympathetic to the plight of minorities. Because of his compulsion to remain moral, he determined to revise a moral code by which he could not abide. The new moral message "manifested" in his works is fraught with social implications. The works inspired by autobiographical experience present in ironical form the dangers of yielding to the Satanical temptations of the absolute, which blind us to our duties to ourselves and to others. The mythological works present by means of suggestive symbols the humanistic system of an artist concerned with the progress of humanity. Gide's social concern, devoid of any clear political implications, appears as having preoccupied him constantly through his creative years. Gradually, as he formulated through his works his revolutionary moral code, he brought to public attention the plight of downtrodden minorities, from homosexuals and criminals to the colonized peoples of Africa. His open espousal of the Communist cause, to which he felt attracted almost since the days of the October Revolution, followed shortly what he believed to be the completion of his creative works. He joined the Communist ranks with the belief that the Soviets were building a social order implementing the Christian precepts of love and brotherhood. Except for momentary failures, he retained his critical sense and his devotion to truth throughout the Communist period of his life. After his disassociation with Russian Communism and following the upheavals of the Second World War, he voiced in Thésée his hope that humanity may be saved and propounded a social and political ideal combining the French eighteenth-century concept of the benevolent despot and the social structure of the Greek city-state.

In conclusion, André Gide's social concern, of which the pseudo-Communist political faith was only a passing aspect, has been a lifelong preoccupation, aroused by a revolt against a restrictive ethical code, and predicated upon a sense of Christian compassion, an outcast's sympathy for the downtrodden and a humanist's belief in progress. 278 pages. $3.60.

THE NEO-CLASSICAL ELEMENTS IN THE MIND AND ART OF ROBERT BURNS

(L. C. Card No. Mic 58-2320)

(Frederick) Boyd Collins, Ph.D.
Michigan State University, 1957

Robert Burns is generally classified as a transitional poet, one whose life, thought, and work lie somewhere between those two aggressive and distinctive literary forces--the Romantic Revival and the Augustan Age. The term Pre-Romantic, the designation most frequently applied to Burns, tends to focus attention upon those aspects of the Scotsman's mind and art that presage Romanticism. The other aspects, those that harken back to the first half of the eighteenth century, have been stressed to a lesser degree--in a few cases, ignored. Many of the artistic principles, thought patterns, and environmental influences that lie at the base of Burns's creativity show a marked Augustan bent. The purpose of this study is to point out these various Augustan elements and to show why they may be termed Augustan.

Robert Burns considered himself and the time in which he lived an integral part of the Augustan tradition. He borrowed liberally from Neo-Classical writers and usually proudly acknowledged his sources. Unlike some Romantic writers, he rarely suffered from artistic loneliness.

Having no personal theories on the nature and functions of art, Burns relied upon the Augustans for whatever artistic principles and practices he needed. In the Neo-Classical manner, he used commonplace themes, accepted and tried forms, a simple vocabulary, and proverbial observations and truisms.

For a faith, Burns turned to the "natural religion" of Pope and Addison. It satisfied his gregarious, unmystical nature and offered him a welcome relief from the severity of Calvinism.

In his "thisworldly" stress upon what he called the "very present business at hand," Burns was essentially Augustan. He had a practical, commonsense view of life, and a genuine, unabashed love of the carnal. Like the Augustans, his main concern as a writer was with actual people and their problems; he was only mildly introspective. Like most men of his century, he had a natural dislike for extremes.

The various Augustan elements in Burns meet in his satire. It is in his satire that Burns is most conclusively a part of the mind and temper of the era that preceded him - and farthest from the climate of opinion that is Romanticism. 166 pages. $2.20.

THE SOCIAL NOVEL OF PERU, 1920-1952

(L. C. Card No. Mic 58-1204)

Louis Joseph Cortés, Ph.D.
University of Colorado, 1957

Supervisor: Professor José De Onís

This study of the Peruvian social novel from its beginnings in the 1920s to the present time was made to determine the nature of the origins, development, trends, ideas and influences of the genre. The study was undertaken with the foreknowledge that there was a body of writers in Peru actively engaged in the ranks of that country's leading political opposition party, the Alianza Popular Revolucionaria Americana (APRA), whose work was of a socio-literary character. Was the social novel limited to this group, or were there other similar groups engaged in the development of the genre? Were there common denominators between these groups? The study revealed

that the social novel of Peru had its beginnings in the literary work of certain late nineteenth and early twentieth century precursors who, under the influence of nationalism and positivistic thought, began to analyze their epoch with the critical spirit of the age. Their work was denunciatory. They saw their contemporary society divided into an upper class of privilege and a lower class in want. The mass of Indians of the Andean highland, comprising sixty to eighty per cent of the population, were the first to be championed as a have-not group by these men of letters.

The work of the precursors was continued by Colónida, a group composed of the young intellectuals of the period of World War I. The latter wished to create a completely native literature, and, though it failed in this aim, it awakened the consciousness of the country to its former great Indian culture and aroused pride in the autocthonous. The first literary expression of indigenism thus tended to depict the glories of the Indian past. This trend was opposed by a more radical group of indigenists who, under the Marxian influence of the post World War I period, advocated an emphasis on the literary expression of the social realities of the Indian masses, which resulted in a literary preoccupation with social problems rather than with artistic creation in the novel. The latter wing of indigenism became dominant, and it influenced not only the indigenist novel but also the proletarian novel which reflects the condition of the agricultural workers of the coastal region, of the lower classes in the cities, and of ethnic minorities. Writers of social novels seem intent on pointing out and protesting such historic events as the destruction of the Indian communal lands, the exploitation of the Indian as agricultural worker, miner or servant; the rapacious nature of government and its destructive effect upon the various ethnic minorities; the close tie of the church, the capitalist and the foreigner in their exploitation of the native; and, lastly, the role of the intellectual in the possible revindication of the exploited native.

The value of the social novel, although not great artistically, serves as an insight into the social thinking of writers regarding their world. They do not like what they see about them, they desire to change the composition of their society, each according to his social, ethnic or philosophic view. This concern with their ambient affords a wealth of vision in human and humanistic efforts in calling attention to their actual circumstances and the potentialities for change. 224 pages. $2.90.

THE FOREIGN QUARTERLY REVIEW (1827-1846): A BRITISH INTERPRETATION OF MODERN EUROPEAN LITERATURE

(L. C. Card No. Mic 58-2435)

Eileen Mary Curran, Ph.D.
Cornell University, 1958

The Foreign Quarterly was the first successful English Review to devote itself to the consideration of foreign literature, and it survived longer than any other early nineteenth-century Review with a similar emphasis. This study traces the Review's history and its criticism of Continental literature. One appendix identifies reviewers, all of whom were anonymous; another provides sketches of obscure reviewers.

In 1826 Sir Walter Scott suggested that Robert Pearse Gillies found a Review of foreign literature. In July, 1827, the book-selling house of Treuttel and Würtz published the first number of the Foreign Quarterly. Soon John George Cochrane superseded both Gillies and his assistant, William Fraser, though Gillies nominally remained editor until March, 1830. When in 1834 Adolphus Richter, who succeeded Treuttel and Würtz, declared bankruptcy, Cochrane issued the Review's 28th number at his own risk. He then resigned after disagreeing with Richter's trustees. The next editor, unidentified, was interested in Egyptology and the Turko-Russian question.

In 1838 B. Edward Pote became editor. Now Tory for the first time, the Foreign Quarterly hysterically attacked French and German works as abominations. In 1840 Dr. James Worthington, another Tory and an Anglican priest, succeeded Pote. Though his numbers show more variety than Pote's, the Review was moribund when Chapman and Hall purchased it in 1841 and tried to force Worthington's resignation. Thackeray was a candidate for the editorship, which in 1842 the new publisher gave to John Forster. With him, in spite of a pledge to maintain the Review's conservatism, came predominately liberal contributors.

In 1840 Forster, who had given literature more space than did previous editors, was succeeded by John Relly Beard, a Unitarian educator and journalist. Still liberal, the Review paid increasingly less attention to literature. Many articles dealt with India and drew on unpublished eye-witness accounts. In 1846, after the 74th number, the Foreign Quarterly merged with the Westminster Review, which until 1888 bore the title Westminster and Foreign Quarterly.

Interpreting literature as the expression of national spirit, the Foreign Quarterly experienced difficulty in assessing writers like Goethe who defied national classification. In 1832 Carlyle praised Goethe as the strong one of the age; most later reviewers, condemning Goethe for withdrawing from life, called him diseased and his irony immoral. Only Schiller received steady praise; in most German works reviewers found exaggeration, cloudy mysticism, and overindulgence in feeling and imagination. These they considered typically German. Noting most writers only after their deaths, they condemned them not as individuals but as representatives of German Romantic forms. Later reviewers applauded the political turn of German poetry in the 1840's and deemed even Heine to be well-meaning.

Early reviewers distinguished between French belles-lettres and other publications. They considered inartistic the French substitution of novelty and intensity for proportion and restraint but praised Victor Hugo for truthful characterization and skilful plotting, Paul de Kock for verisimilitude in creating middleclass characters. From 1835 to 1842 the Foreign Quarterly attacked the moral and political error of Hugo and George Sand. Later George Henry Lewes held Sand morally and artistically superior to Balzac. Lewes regretted only her later novels, marred by the feuilleton. French drama he praised when it returned to classic and therefore national forms.

The reviewers judged writers of other nations as national spokesmen. Drama interested them as the most intensely national genre. The Foreign Quarterly derived

its greatest virtue from this national emphasis: it tried to judge foreign works by the standards governing their composition. Generally it failed; English criteria are painfully evident. The Foreign Quarterly nevertheless showed surprising knowledge of foreign literature and uneasy awareness of the limitations of English standards.
451 pages. $5.75.

POE AND COSMOLOGY: THE GOD-UNIVERSE RELATIONSHIP IN A ROMANTIC CONTEXT

(L. C. Card No. Mic 58-1696)

Hugh Bernard Fox, Jr., Ph.D.
University of Illinois, 1958

Cosmologically, the Romantic Movement represents a reaction against the Mechanism and Deism of the seventeenth and eighteenth centuries. Wordsworth, Coleridge, Blake, Emerson and Poe stressed the proximity of God and the universe because the eighteenth-century that preceded them had stressed God's remoteness from the universe. The Romantics stressed the possibility of intercommunication between God and man because the Rationalists had seemed to deny man is communication with the spiritual world around or above him.

Although Poe, as a Romantic, rebelled against the rationalism of the eighteenth-century, his rebellion was curiously ambivalent. He was actually half Rationalist and half Romantic. As a Rationalist he appreciated the deistic universe with its mechanical precision and its glorification of man's analytical abilities; in this respect he was like the analytical Dupin of "The Murders of the Rue Morgue" and "The Mystery of Marie Roget." Yet, just as there was a romantic side to Dupin, however, there was also a romantic side to Poe, Poe the Romantic found the deistic concept of the universe repellent. The Romantic Poe viewed God and the universe as one and stressed man's intuition rather than his reason. This romantic-rationalistic duality runs throughout Poe's tales and poems and is also found in Eureka.

The universe in "The Island of the Fay" (1841), for example, is basically romantic. The tale is not merely an account of the author watching the death of a fay, but an affirmation on Poe's part that the world of spirit is open to man. The fay represents an actual point of contact between God and man. Here Poe establishes the communication between God and man that man had been denied by the Rationalists; here the entire universe has God for its center.

The universe of "The Mystery of Marie Roget" (1842), on the contrary, is completely rationalistic. There is no contact whatsoever with God; everything here is considered in terms of the natural without any recourse to the preternatural. Even the most startling coincidences are explained in terms of mathematical probability. Poe here attempts to create a universe in which everything is explicable in terms of reason.

Poe's duality began in the self and extended outward from the self to include the entire universe. The analytical Poe was content to explore reality with his mind as if mind were adequate to such an exploration. The intuitional or imaginative Poe, however, did not explore but shaped reality; his thought, like that of God, creates.

It is the godlike artist who triumphed in the latter part of Eureka. There, Poe created an entire cosmology based on intuition. This artist-created world entirely superseded the objective, deistic world of the first part of Eureka. Here the romantic-rationalistic vacillation is resolved, and Poe the Romantic displaces Poe the Rationalist.
113 pages. $2.00.

THE REPUTATION OF D. H. LAWRENCE IN AMERICA

(L. C. Card No. Mic 58-1408)

Martin Burgess Green, Ph.D.
University of Michigan, 1957

This is a study of all the books, parts of books, essays, and reviews devoted to Lawrence, and published in America, or by American writers in foreign publications. Its main purpose is to chart the rise and fall, and the changing shape, of his reputation. Secondly it takes an interest in the people in whom these varying passions of approval and disapproval were aroused, not as individuals, but as representatives of intellectual trends. The climate of the times is described - in fact, three climates, for the period covered, 1911 to 1956, has been divided into three from this point of view - and some connection is traced between Lawrence's reputation, as it waxed and waned, and the shifting tides of general opinion.

Chapter I, which deals with the period before 1930, finds some subdivision necessary, both in the climate of opinion, and in the history of Lawrence's reputation. Though the two leading critical schools of the period may be said to be that led by Irving Babbitt, and that led by H. L. Mencken, there were many important writers of the 1920s, all the expatriate, experimental writers, who moved in an intellectual atmosphere remote from both of them. It was this latter atmosphere which was most favourable to Lawrence. Neither Babbitt nor Mencken had any interest in him; it was critics like Amy Lowell and Ezra Pound who first praised him enthusiastically, and it was the little magazines which first published him. Amongst those writers and readers Lawrence was established, by 1920, as a great new writer from whom much was expected. By 1925, however, and particularly with the publication of Studies in Classic American Literature, the tide of opinion began to turn against him. He was too much the preacher and the puritan, too little the artist, too reactionary, not civilized enough, for the readers of The Dial. He remained a centre of great excitement, at every level of seriousness, but after 1925, it is difficult to find an article which neither misrepresented nor condemned him.

In the 1930s the atmosphere was much less favourable to Lawrence, because critics suspected anything that smacked of reaction, mysticism, or escapism. Lawrence's indifference to social reform and to the class struggle, and his doctrine of the blood, seemed to make him at least a preparer for Fascism. There were a great many articles and reviews devoted to him in the first three years of the decade, when his posthumous works and the biographies of him were being published, but most serious writers of the time were more concerned to condemn than to praise him.

The third chapter deals with the period after 1940. By that date interest in Lawrence was very low, and nothing happened to revive it before 1947. The guidance of critical opinion was passing to the New Critics, whose insistence on formal and artistic discipline, and those preference for tradition in religious and political matters, were not favourable to him. The less highly trained in literature found Lawrence's preoccupation with himself alien in time of war. In this period indifference to Lawrence was so great that even ascertainable facts of his appearance, family background, and life history, were often grossly distorted in articles about him. But after 1947, which is the date of publication of the Viking Portable Lawrence, certain other features of his work, more compatible with current literary theory, began to be noticed. His indifference to politics, and his interest in myth and symbol, began to seem evidence of the true artist. It is in this period, and by the English equivalent of the New Critics, F. R. Leavis, that Lawrence has been accepted on the terms on which he offered himself. 301 pages. $3.90.

ROGER MARTIN DU GARD'S PHILOSOPHY OF LIFE AS VIEWED THROUGH HIS TREATMENT OF THE THEME OF LOVE

(L. C. Card No. Mic 58-2214)

Thomas White Hall, Ph.D.
University of Maryland, 1958

Supervisor: Professor William F. Falls

This thesis is an exhaustive study of the theme of love in both its sexual and non-sexual manifestations in the novels and plays of Roger Martin du Gard. The success or failure of love, in various case histories, is used as a measurement in determining the degree of pessimism implicit in his philosophy of life. The ascertaining of the limits of his hope for mankind contributes to a mise au point of divergent critical interpretation and to cataloguing more specifically his place in contemporary French literature. 195 pages. $2.55.

GEORGE WITHER'S SERVICE TO BRITAIN AS PROPHET, HUMANIST, POLITICAL AND RELIGIOUS PAMPHLETEER AFTER 1625

(L. C. Card No. Mic 58-2351)

Charles Stanley Hensley, Ph.D.
University of Missouri, 1958

Supervisor: Professor Hardin Craig

Although Wither's numerous works in prose and verse after the dissipation of his lyric genius rank low as belles-lettres, this study emphasizes their importance for the fullest, most just estimate of his complex personality and stature in seventeenth century literary-social history. The great bulk of the poet's lesser-known, later works, when examined in relation to his youthful publications like Abuses and The Shepherd's Hunting, indicates that the chief motivation for Wither's lifelong thought and action is his zealous obligation to serve his fellow men and himself to the extent of his varied abilities. His didactic impulse, increasing in degree as his puritanism deepened, accounts for his serving as prophet, humanist, political and religious pamphleteer after 1625.

In tracing the sources of Wither's mission of service in his beliefs and experiences before 1625, Chapter I stresses his conviction that human nature is basically evil, his burning desire to edify readers by use of plain language for all to comprehend, and also marks his permanent traits or attitudes, such as content amid discontent, courageous individualism, and strong anti-Catholic bias. Chapter II examines the poet's familiar and most characteristic service to his countrymen in Britain's Remembrancer, his most ambitious poem prompted by the bubonic plague of 1625. Here he first employs his prophetic role to admonish his readers to cure social evils of the day by practicing "inner reform," a warning reiterated in numerous later works. This remarkable poem, besides its biographical interest, has considerable historical value because of Wither's eyewitness description of plague devastation in London and his indictment of the abuses of lawyers, clergy, and nobility during this time. Chapter III emphasizes the poet's humanistic bent evident in Preparation to the Psalter but fully employed, as an indirect means of inculcating "inner reform," in his translation of Nemesius' Nature of Man, in The Modern Statesman and Fides-Anglicana. Wither's classical scholarship and liberal sympathies revealed in these unfamiliar works provide a fresh insight into his character and suggest that his formal education and intellectual curiosity were greater than heretofore supposed. The first English translation from two sixteenth century Latin versions of the Greek text, the poet's Nature of Man accurately renders this "mozaic" of Greek natural history and Christian apologetics for his unlearned reader. In the two other publications Wither further utilizes ancient, learned authority to support his own views. From Roman history and philosophy, he cites precedents of valor, piety, prudence, and justice for the fledgling Protectorate to imitate. Chapter IV stresses the impressive moderation of the poet's political and religious thought in relation to his efforts as soldier, civil-servant, and pamphleteer for the Parliamentary cause. His conspicuous avoidance of a strict partisanship after his humanistic studies began reflects his devotion to abstract truth and preoccupation with ethical-moral principles underlying conduct. While he defends the Parliamentary as the more "righteous" cause and provides sound, practical advice about sequestration and parliamentary membership, Wither repeatedly warns his own party to practice "inner reform" in order to establish a sound republican government. The Speech without Doore, Prosopopoeia Britannica, and The Perpetual Parliament reveal fully his typical political attitudes. Wither's increasing emphasis on reason as a guide to faith typifies his latitudinarian views during the Interregnum. A lifelong Anglican with a puritan temperament, Wither particularly advocates toleration after 1660 for all Protestants who can agree on essentials of the Christian faith in Paralellogrammaton, in which he also reiterates his prophecy that Antichrist will be overcome in 1666.

Because of humanistic bent and his insistence on toleration, Wither deserves our respect in spite of his Cassandra complex. 223 pages. $2.90

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

THE IMPACT OF FRENCH NATURALISTS AND PSYCHOLOGISTS ON AUGUST STRINDBERG'S PLAYS OF THE 1880'S AND EARLY 1890'S

(L. C. Card No. Mic 58-2157)

Børge Gedsø Madsen, Ph.D.
University of Minnesota, 1958

A close study of August Strindberg's letters and essays reveals that Strindberg consciously adapted some of the leading ideas of French naturalists and nineteenth-century psychologists in his own literary work. The purpose of this thesis is to determine to what extent Strindberg did so in his drama of the 1880's and early 1890's.

In his critical writings of the 1880's Emile Zola called for a "new formula" (la nouvelle formule) for the naturalistic theatre. By this expression Zola meant a combination of realism of décor and a deterministic psychological-physiological method of characterization with classic grandeur and simplicity, in a true-to-life performance. He summed up his definition of the new naturalistic formula in the three phrases of faire vrai, faire grand, et faire simple.

Most of August Strindberg's plays written in the period 1886-1892 show traces of Strindberg's familiarity with Zola's new formula and his knowledge of the repertoire of the French Théâtre Libre. Fadren is written in the grand or grandiose manner; Fröken Julie embodies the principle of writing truthfully in the naturalistic sense of the word; and Fordringsägare satisfies to a certain extent the faire simple part of the formula. In Fadren, however, Strindberg exaggerates the faire grand part of the new formula, and the play therefore becomes deficient in the formula's insistence on verisimilitude (faire vrai). Zola found the characters in Fadren too abstract and intellectual. Fordringsägare fulfills the naturalistic principles of simplicity of structure and concentration on the psychological aspects of the analysis of character. But by stressing these elements to the exclusion of all others, this play, like Fadren, neglects the description of the décor and its determining influence on the characters and the action. Strindberg's three quart d'heure plays Paria, Den starkare, and Samum, which were modeled on Les Quarts d'heure of Gustave Guiches and Henri Lavedan, are an extreme version of naturalistic simplicity. In his last six naturalistic plays (Debet och Kredit, Första varningen, Leka med elden, Moderskärlek, Inför döden, and Bandet) Strindberg is indebted to Henry Becque's La Navette for his one-act play form (den utförda enaktaren) and to the French comédie rosse for some of the witty cynicisms which these plays contain.

Strindberg's plays of the naturalistic period reveal indebtedness not only to Zola's new formula but also to some of the novels of the Goncourt brothers and to the work of distinguished French psychologists. Fröken Julie shows traces of influence from the Goncourt novels Chérie, and La Faustin. Bernheim's hypothesis that hypnosis is possible in a conscious state, Prosper Lucas' theory of impregnation, and Ribot's concept of the multiplicity of the ego all left their mark on Strindberg's work. Furthermore, such general naturalistic ideas and aesthetic principles as pessimism, misogyny, and brutal outspokenness of language are found in Strindberg's naturalistic theatre.

Strindberg's subjectivity prevented him from ever becoming a doctrinaire naturalist in all respects. Despite their elements of naturalism, most of his plays from the period 1886-1892 in their method of characterization and style show occasional examples of a distortion and heightening of reality which gives the impression of stylization rather than of verisimilitude. It is significant that the work by Zola which Strindberg preferred was the lyrical novel La Faute de l'abbé Mouret, which he characterized as a "colossal poem." 245 pages. $3.20.

LUGNE-POE ET LE THEATRE DE L'OEUVRE

(L. C. Card No. Mic 58-2244)

Eliane Roussin, Ph.D.
Columbia University, 1958

Lugné-Poe (1869-1940) a dirigé pendant trente-six ans le théâtre de l'OEuvre. A l'epoque ou l'OEuvre est fondée, en 1893, la carence des écri-vains symbolistes se fait déjà sentir. Pendant quatre ans, cependant, Lugné-Poe essaie de défendre la doctrine symboliste sur la scène. En 1897, il renonce officiellement au Symbolisme.

Pendant cette premiere période, Lugné-Poe a également combattu pour le théâtre scandinave et, malgré les erreurs qu'il a pu commettre au début, il contribue grandement a la propagande des oeuvres d'Ibsen, Björnson, Strindberg, etc. en France.

Apres sa rupture avec le Symbolisme, Lugné pense que la fin de l'OEuvre est déjà arrivee. Dès la saison 1889-90, il reprend pourtant Un Ennemi du peuple et bientôt on assiste à une vraie renaissance de l'OEuvre. Pendant cette deuxième période, considérée en général comme secondaire par rapport à la période dite "héroïque", l'OEuvre reste encore avant tout un théâtre d'avant-garde. De 1900 à 1910, Lugné-Poe révèle au public parisien bien des oeuvres intéressantes de la litterature française et étrangère: Gide, Savoir, Wilbrandt, d'Annunzio, etc. Il fait preuve d'un grand éclectisme dans son choix et donne un apercu assez brillant de la production théâtrale de l'époque.

Aux approches de 1912, on commerce a beaucoup parler d'une période de Renaissance poétique en France. L'OEuvre participe brillamment à cette renaissance de la poésie au théâtre en jouant L'Annonce faite à Marie et L'Otage de Claudel, La Brebis égarée de Francis Jammes et Le Baladin du monde occidental de John Synge. On loue Lugné-Poe d'avoir réussi à faire disparaître la légende d'obscurité qui entoure les pieces de Claudel et on le félicite d'avoir réhabilité son propre théâtre.

Jusqu'a la premiere guerre mondiale, l'OEuvre a erré d'un théâtre dans l'sutre pour donner ses représentations. En 1920, Lugné-Poe acquiert enfin un local dans la rue de Clichy. Pendant la période d'entre-deux guerres, il participe au renouvellement du théâtre parisien et s'emploie à trouver les createurs que le théâtre reclame. Jusqu'à la vente de "OEuvre en 1929, il aide à la découverte et au lancement de toute une autre génération de jeunes écrivains parmi lesquels Jean Sarment, Jacques Natanson, Marcel Achard, Stève Passeur, Armand Salacrou, Roger Ferdinand, Fernand Crommelynck.

Dans la vie de l'OEuvre, les tournées ont eu une grande

importance car c'est grâce à elles que le théâtre a pu continuer à vivre. Suzanne Desprès, la compagne fidèle, à qui l'OEuvre doit tant, porte un peu partout une gloire sans cesse croissante et le renom de ce théâtre.

Lugné-Poe a joué un rôle important non seulement en tant qu'animateur et découvreur, il s'est également intéressé aux multiples problèmes de la scene, tels que ceux de l'interprêtation, de la mise en scène et du choix des différéntes techniques qu'elle entraîne mais il ne l'a jamais fait systématiquement et on ne peut le placer au rang des theoriciens. Il fait venir des artistes étrangers, organise des conférences, des recitals, s'occupe de critique théâtrale. Directeur autant dire anonyme du bulletin de L'OEuvre, il cherche à créer une revue d'information sur le théâtre français et étranger. Toutes les fois qu'il en a l'occasion, il affirme sa foi dans le renouvellement du théâtre par les auteurs. 301 pages. $3.90.

HERDER AND SWIFT

(L. C. Card No. Mic 58-2450)

James Maurice Spillane, Ph.D.
Cornell University, 1958

Scholars have long recognized the existence of a definite relationship between Johann Gottfried Herder and Jonathan Swift. Rudolf Haym, for example, in his late nineteenth century biographical and critical study of Herder, refers to Swift as one of Herder's "Lieblingsautoren." Later critics have considerably amplified Haym's statement and have shed more light on the affinity between the two men.[1] Goethe also, from quite a different vantage point, in Dichtung und Wahrheit, has given us direct evidence of Herder's predilection for Swift. As he looked back upon his Strassburg association with Herder, Goethe recalled that: "Herder schien unter allen Schriftstellern und Menschen Swiften am meisten zu ehren."

An examination of Herder's writings verifies this deep interest in the English satirist. There is an impressive mass of references to Swift in Herder's work indicating an intermittent but steady preoccupation on Herder's part throughout the greater part of his life. These references should be evaluated, not only to establish the direction of Herder's interest in, and his critical opinion of, the English satirist, but also to shed additional light on Swift's role in eighteenth century Germany.

Herder read and admired Swift but did not wholeheartedly endorse all of his pronouncements. He disagreed, for example, with Swift's treatment of Western Religions in his Tale of a Tub and wrote an answer or "Gegenstück" to it, Das Mährchen vom Spiegel. He was also horrified at the patent lack of "Humanität" in Swift's sardonic verses on his own death, Verses on the Death of Dr. Swift, and countered with Das Mitgefühl, a very lengthy refutation of the cynical amour-propre which is the basis of the Swift poem. These and other examples which illustrate the direct impact of Swift's writings on Herder have hitherto gone unnoticed in Herder criticism. His translations and "Nachdichtungen" from Swift have also never been investigated adequately.

Such are the obvious "facts" which link the two men together. However, the picture is not yet complete. A singular concurrence of basic ideas in the work of the two men invites comparison. An important theme in their early writing is a negative, almost nihilistic attitude towards contemporary man and his achievements. This is reflected primarily in A Tale of a Tub and Auch eine Philosophie der Geschichte. Both men in their conservatism were not convinced of the validity of the Theory of Progress and looking at every facet of contemporary life found the old better than the new. Such an attitude which offered little hope to eighteenth century man gave way, however, in their later, mature writing to one of optimistic idealism. The final testament of both men was a belief in man's ability to attain an ideal state envisioned by Swift in his Gulliver's Travels, Part IV and by Herder in his Ideen and Briefe zur Beförderung der Humanität. This implies a dynamic shift of attitude on the part of these two important European figures, a shift which not only calls attention to an interesting relationship in the history of ideas but also illustrates the depth of Herder's understanding of Swift. For Herder pointed out this idealism in Swift and in seeing him not as an embittered misanthrope but as a friend of man he, uniquely in the eighteenth century, anticipated some of the best of modern Swift criticism.

226 pages. $2.95.

1. See: Vera Philippovic, Swift in Deutschland (Agram, 1903); Dr. Luise Schork, Herders Bekanntschaft mit der englischen Literature (Breslau, 1928); Robert T. Clark, Jr., Herder, His Life and Thought (Berkeley, 1955).

THE BASES OF SATIRE IN GUSTAV MEYRINK'S WORK

(L. C. Card No. Mic 58-1476)

William Riley van Buskirk, Jr., Ph.D.
University of Michigan, 1957

This study is an attempt to explain Gustav Meyrink's satires and to place their author in history as a literary personality. Studies have been made concerning his role as a mystic and about his Weltanschauung but there is no detailed work dealing with his considerable satirical writings. Such a study is important in order to appraise the man in his entirety. Previous statements about Meyrink's satires have been incomplete due to their brevity and this investigation proposes to fill the gaps.

Since the study will use biographical and historical tools, it begins with a brief biography. This is to fill the need for a more detailed account of his life and to furnish a factual basis for criticism. The intellectual and historical context of the time in which Meyrink lived is next presented to provide the setting for his satires. Before dealing with the satires themselves a discussion of the history of satire in the West and its definitions is set forth. Following this, it is shown that Meyrink became a satirist through a combination of circumstances and spiritual necessities. The attacks in his satires were generally directed against the military, financiers, Spiessertum and science in its dogmatic sense.

The next part of the study deals with the satires themselves. The satirical works are listed and characterized briefly according to literary types. Representatives are

then selected and analyzed with regard to literary, historical and biographical elements contained therein. The satires reveal strong biographical influences and reactions symptomatic of Meyrink's time. They also show his conflict as a mystic with the dominantly materialistic outlook of Western society.

The investigation confirms the opinions of previous critics as to the targets of Meyrink's satires. The material indicates that the bases of his satires can be found in his life, particularly in his experiences in Prague, and in his reactions as a mystic to a materialistic society. Moreover, his personality, though paradoxical, expressed a moral concern for humanity by attacking what he felt to be the false values of this world in order to make room for the growth of a more real inner world. In this he was related to the Expressionistic movement.

247 pages. $3.20.

RELIGION IN MODERN ENGLISH DRAMA

(L. C. Card No. Mic 58-2249)

Gerald Clifford Weales, Ph.D.
Columbia University, 1958

This study is an examination of the way in which religion has been used in English drama since the end of the nineteenth century.

Part I is devoted to the commercial stage. The plays under consideration here are divided into five main categories: (1) plays, such as those of Henry Arthur Jones, in which religious experience or anti-religious attitudes are presented in a contemporary setting; (2) pseudo-religious costume melodramas, such as those of Wilson Barrett, and related Biblical plays; (3) plays, such as The Passing of the Third Floor Back, which mix sentimentalism and the supernatural; (4) plays, such as Candida and The Importance of Being Earnest, in which clergymen function in non-clerical roles; and (5) plays, such as those of Bernard Shaw and James Bridie, in which religious terminology and ideas are presented in a special context.

Part II traces the history of the church drama movement in England from William Poel's revival of Everyman (1901) to World War II, with special emphasis on the formation of the Religious Drama Society and the initiation of the Canterbury Festival. The works of the important contributors to the church drama movement--Laurence Housman, John Masefield, Charles Williams and Dorothy L. Sayers--are examined in detail.

Part III describes the state of religious drama in England in the post-war years when the two streams of religious drama met in the commercial success of playwrights, such as T. S. Eliot and Christopher Fry, who began their work in church festivals. The work of Eliot and Fry is examined extensively. Close attention is also paid to continued evidences of religion in commercial drama (with special attention to Graham Greene), to the work of poetic religious dramatists, such as Ronald Duncan and Anne Ridler, and to the activities of the church drama movement since the war.

In concludion, the two approaches to religious drama--the aesthetic and the evangelical--are discussed. On the evidence of the 476 plays examined in this study, the conclusion is reached that the evangelical plays make no contribution to the body of English drama. The literary value of the aesthetic approach depends finally on the merits of particular religious playwrights. Religious ideas are as valid as any other ideas as material for drama, but it is the playwright and not the idea that makes a play.

664 pages. $8.40.

REFLECTION PRINCIPLES FOR SOLUTIONS OF EQUATIONS IN ELASTICITY

(L. C. Card No. Mic 58-2206)

James Henry Bramble, Ph.D.
University of Maryland, 1958

Supervisor: Professor L. E. Payne

The purpose of this paper is to establish certain reflection principles (analogous to the classical Schwarz reflection principle for harmonic functions) for biharmonic function which arise as solutions of equations in elasticity. The first part contains a development of certain representation theorems for these functions in terms of harmonic functions. These theorems are used to derive explicit formulae for the continuation of a biharmonic function w across a circular arc Q when various boundary conditions are satisfied on Q.

The following sets of conditions are considered.

A	$w = M(w) = O$	on Q
B	$M(w) = V(w) = O$	on Q
C	$W_r = V(w) = O$	on Q

where $M(w) = \Delta w + \frac{1-\sigma}{\sigma} W_{rr}$ and $V(w) = \frac{\partial}{\partial n}(\Delta w) + (1-\sigma)\frac{1}{a^2}[W_{e\theta n} - \frac{1}{a} W_{e\theta}]_1$ Δ being the Laplace operator and a the radius of the circle. If σ is taken to be Poisson's ratio, then A and B correspond physically to the cases where Q is the edge of an elastic plate which is "simply supported" and "free" respectively. Condition C corresponds to the so called "sliding clamped" case.

In addition to the plate problems, elastic medium problems are considered. Explicit formulae are given for the continuation of the displacement vector across a circular arc or spherical surface in two or three dimensions respectively, provided the displacements vanish on the arc or surface. Finally, consideration is given to the two dimensional problem in which the normal stresses vanish on the circular boundary Q. The biharmonic Airy stress function is introduced and methods similar to those employed in the plate problems are used to obtain an explicit continuation formula for this function. The continuation of the stresses can then be obtained by differentiation.

63 pages. $2.00.

THE DISTRIBUTION OF THE NUMBER OF COMPONENTS OF A RANDOM MAPPING FUNCTION

(L. C. Card No. Mic 58-2420)

Jay Ernest Folkert, Ph.D.
Michigan State University, 1955

From the collection, F, of functions, f, which map the set, Ω, of N elements into Ω, the general subclass, $G_{\{r_i\}}$, is selected. This class is composed of functions such that for each $f \in G_{\{r_i\}}$ the point $x_i \in \Omega$ has r_i images in Ω, i = 1, 2, . . . , N. A probability space is constructed by taking $G_{\{r_i\}}$ and attaching equal probability to each $f \in G_{\{r_i\}}$. A random mapping of Ω into Ω relative to $G_{\{r_i\}}$ is defined as corresponding to the selection of an f from $G_{\{r_i\}}$ with uniform probability.

A subset ω of Ω of a component of the function if and only if it is a minimal, non-null subset such that $f(\omega) \subset \omega$ and $f^{-1}(\omega) \subset \omega$. Every mapping function, $f \in G_{\{r_i\}}$ decomposes Ω into a number of disjoint components. Therefore, to each f in $G_{\{r_i\}}$ there corresponds a number, c, which is the number of components induced in Ω by this f. If f is selected at random from $G_{\{r_i\}}$ then c is a random variable. The problem is to find the probability distribution of c.

The method used is one in which auxiliary sums, S_μ, $\mu = 1, 2, \ldots, N$ are defined. These sums are accounted for by two approaches. By the first approach a formula in terms of N and r_i is derived for computation of S_μ, $\mu = 1, 2, \ldots, N$. By the second approach, S_μ is found in terms of the probability, P_c, of exactly c components, c = 1, 2, ... , N. A matrix solution of this expression for P_c in terms of S_μ is given. The result is the exact probability distribution of the number of components.

Particular cases of general mapping are considered as specializations of the mapping under $G_{\{r_i\}}$. These are the subclass, G_r, of functions under which each element of Ω has the same number, r, of images and the subclass, G_1. of functions under which each element of Ω has only one image.

Hollow mapping in the sense that no point is permitted to map into itself is also considered. For this case, the subclasses, H_{r_i}, H_r, and H_1 are defined in a manner parallel to the general case and the exact probability distribution is found for each.

Numerical examples are included to illustrate each of the cases considered. The amount of computation involved in these suggests the need for an approximation to the exact distribution. Therefore a binomial approximation is developed. The results of the exact and approximate distributions for these examples are included in tabular form for reasons of comparison. 62 pages. $2.00.

CONTRIBUTIONS TO THE GENERAL THEORY OF SAMPLING FINITE POPULATIONS WITHOUT REPLACEMENT AND WITH UNEQUAL PROBABILITIES

(L. C. Card No. Mic 58-2381)

John Clement Koop, Ph.D.
North Carolina State College, 1958

Supervisor: Alva Leroy Finkner

Within the total range encompassed by the present unified theory of sampling there are various special fields not all of which have been fully explored. In this thesis the special theory appropriate to the situation when the elements (as units of sampling) are selected one at a time, without replacement and with unequal probabilities, is given on the basis of a most general probability system.

The seven general linear estimators of the population total have been constructed deductively on the basis of the three axioms of sample formation. Each estimator typifies a class. Each of the known unbiased estimators was shown to belong to one of these seven classes. Also from the most general linear estimator (in class seven) all known unbiased estimators have been derived. One new unbiased estimator in class six was brought to light.

Minimum variance estimators which are independent of the properties of the population do not exist in each class. But formally they do, and they supply the bases for the derivation of simulated minimum variance estimators when auxiliary information on a characteristic related to the one under investigation is available for all units of the population.

The unbiased estimator in class three is always more efficient than the one in class six. In regard to other comparisons it has been found that efficiency is dependent on the kind of probability system used.

The problem of negative estimates of variance is considered and meaningful interpretations are given for those unbiased estimators in class three and class six. The existence of probability systems, for which every possible estimate of variance of the unbiased estimators in classes two, three and five shall be positive, is proved.

The problem of optimum probabilities in multivariate sampling with general cost functions is formulated in the most general way and a formal solution is given.

127 pages. $2.00.

AN INVESTIGATION OF CERTAIN COMBINATORIAL PROPERTIES OF PARTIALLY BALANCED INCOMPLETE BLOCK EXPERIMENTAL DESIGNS AND ASSOCIATION SCHEMES, WITH A DETAILED STUDY OF DESIGNS OF LATIN SQUARE AND RELATED TYPES

(L. C. Card No. Mic 58-2428)

Dale Marsh Mesner, Ph.D.
Michigan State University, 1956

A partially balanced incomplete block (PBIB) design is an arrangement of a set of experimental treatments into smaller subsets, or blocks, in accordance with a certain definition. Except for an introductory section in which the role of PBIB designs in the statistical analysis of experiments is discussed, this thesis is concerned with the combinatorial problems that arise in the construction of the designs. The definition states requirements for a relation of association between any two treatments, and the term "association scheme" is used for any method by which a relation of the kind specified can be set up. A considerable portion of the thesis is devoted to the study of association schemes rather than actual designs. Incidence matrices are used throughout the thesis to study the properties of designs and association schemes by algebraic methods.

A method of enumerating combinatorially possible PBIB designs with two classes of associates is outlined, based on both new and old methods. While tables of known designs have been published, no exhaustive tables of all possible PBIB designs have appeared heretofore. An extensive table of the possible parameter values of association schemes is compiled, along with tables of possible parameter values of the designs themselves in the cases of special interest in this study.

Known PBIB designs with two classes of associates have been classified according to the nature of their association schemes, and designs of Latin square type with g constraints, in which the number of treatments is a square n^2 and the association relation may be defined by a set of g mutually orthogonal n x n squares, are singled out for special study here. A related class of new designs is introduced and given the name "negative Latin square." While association schemes for the new designs cannot be constructed from Latin squares, a method based on finite fields is developed and used to construct some schemes of both types, including four in the new series. A fifth is constructed by other methods. Several new designs are constructed from the new association schemes.

Some examples are given to show the possibility of association schemes which have exactly the same parameter values as those of Latin square type with g constraints but in which the association relation cannot be defined by a set of g orthogonal squares. It is then proved that for a fixed value of g, this can be the case only for n less than a certain value, which is expressed as a function of g, and that for larger values of n the Latin square type association scheme is unique. The proof is based on a series of theorems on the structure of incidence matrices, some pertaining only to association schemes and other applying more generally. Some other applications of the methods are suggested.

300 pages. $3.85.

AN INVESTIGATION OF THE EFFECT OF MISCLASSIFICATION ON THE X^2 TESTS IN THE ANALYSIS OF CATEGORICAL DATA

(L. C. Card No. Mic 58-2383)

Vasant Lakshman Mote, Ph.D.
North Carolina State College, 1957

Supervisor: Richard Loree Anderson

This thesis is devoted to an investigation of the effect of misclassification on the use of X^2 tests in the analysis

of categorical data. The following problems of categorical data have been considered:

i) The goodness of fit test.
ii) t x r contingency tables:
  a) for stratified sampling situations
  b) for random sampling situations.

For the goodness of fit test, the frequency table consists of r classes and the null hypothesis specifies the probabilities of an observation falling in different classes. θ_{jk} has been denoted as the probability of wrongly classifying an individual belonging to the j^{th} class into the k^{th} class ($j,k = 1,2,\cdots,r$) and θ_{jj} as the probability of correctly classifying an individual belonging to the j^{th} class in the j_{th} class. Finally

$$\theta(r \times r) = (\theta_{jk}).$$

Two cases have been considered:

i) $\theta(r \times r)$ is non-singular and known.
ii) $\theta(r \times r)$ is non-singular but unknown.

When $\theta(r \times r)$ is non-singular and known, in general, the usual test procedure has to be modified, and misclassification reduces the limiting power.

For the null hypothesis, $p_j = 1/r$, and for a selected set of deviation parameters, the limiting power has been computed, both when misclassification is present and when it is absent. These numerical calculations show that misclassification becomes more serious as the significance probability decreases.

To demonstrate the effect of neglecting misclassification, the following type of misclassification has been considered:

$$\theta_{jk} = \theta \quad j \neq k$$
$$\theta_{jj} = 1 - (r-1)\theta \text{ where } 0 < \theta < 1/r.$$

It is shown that for a fixed value of θ the level of significance tends to 1 as the sample size increases indefinitely; while for values of θ arbitrarily close to zero the level of significance of the said test is greater than α.

When $\theta(r \times r)$ is non-singular but unknown, it is shown that, in general, the number of independent parameters to be estimated exceeds r. To reduce the number of independent unknown parameters, the θ_{jk} have been expressed as functions of one unknown parameter θ. Again the usual test procedure has to be modified. When the null hypothesis is other than $p_j = 1/r$, two estimation procedures for estimating θ have been considered. As before, misclassification reduces the limiting power.

For contingency tables, under certain assumptions regarding the nature of misclassification, it is shown that test procedures for testing the "usual" hypotheses are unaffected. Although misclassification does not affect the test procedures, it does reduce the limiting power.

95 pages. $2.00.

THE QUALITATIVE BEHAVIOR OF INTEGRAL CURVES OF SYSTEMS OF THREE DIFFERENTIAL EQUATIONS NEAR A SINGULAR POINT

(L. C. Card No. Mic 58-2374)

Richard Eugene Zindler, Ph.D.
Michigan State University, 1956

In this thesis the system of differential equations $dx/dt = U(x, y, z)$, $dy/dt = V(x, y, z)$, $dz/dt = W(x, y, z)$ is studied with respect to its qualitative behavior in the neighborhood of an isolated singular point, the origin. A singular point is one for which (a) $U = V = W = O$, (b) one or more of the U, V, W are infinite, or (c) the limit of any one of them is not independent of the direction of approach as $r = \sqrt{x^2 + y^2 + z^2} \longrightarrow O$. Since the only restriction on U, V, W is that they be continuous at all nonsingular points, non-unique solutions of the system are possible.

Exceptional directions are defined as those directions for which the limit of the cosine between a fixed direction and the field vector at a point as the point moves along the line of the fixed direction towards the origin. It is proved that the only possible tangent lines to integral curves of the system at the origin are exceptional directions. It is also shown that exceptional directions are sometimes associated with spiral curves which do not possess a definite tangent as they enter the origin.

The parameter t is held invariant throughout the study. It is shown that any curve which has a definite end point within the region $r < r_o$ must end in the singular point. Also it is shown that any integral curve segment in $r < r_o$ which when extended does not approach $r = O$ or $r = r_o$ is such that $t \longrightarrow \infty$ as one progresses along the curve. If there exists an m such that $O < \Delta_1 \leq r^{-m} \Delta \leq \Delta_2$ for all points within $r < r_2$ (where $\Delta = \sqrt{U^2 + V^2 + W^2}$) then it is shown that (1) if $m \geq 1$ the value of the curve parameter must approach infinity as and if the curve enters the origin and (2) if $m < 1$ and if the curve enters the origin with a definite tangent then the value of the parameter at the origin must be finite.

The system is transformed by means of spherical coordinates r, ϕ, ψ (where ψ is the longitudinal variable) into $dr/dt = P_1(r, \phi, \psi)$, $r\, d\phi/dt = P_2(r, \phi, \psi)$, $r \sin \phi\, d\psi/dt = P_3(r, \phi, \psi)$. Functions $K_i(r, \phi, \psi)$ are defined as P_i/Δ and functions $K_{ij}(r, \phi, \psi)$ are defined as K_i/K_j. The qualitative behavior of curves is determined by the various functions K_{ij}.

The K_{21} function is used to determine whether or not the curve possesses a definite tangent line in the neighborhood of an exceptional direction. For example, if $K_{21} > O$ for $\phi > O$, $K_{21} < O$ for $\phi < O$ and $K_{21} = O$ for $\phi = O$ in a sufficiently small cone about an integral exceptional direction $\phi = O$, then any curve in that cone must enter the origin with $\phi = O$ as its tangent line. However, if $K_{21} < O$ for $\phi > O$, $K_{21} > O$ for $\phi < O$ and $K_{21} = O$ for $\phi = O$ in a sufficiently small cone about $\phi = O$, then no curve which does not contain a point of $\phi = O$ in that cone can enter the origin from that cone.

The function K_{31} is used in conjunction with the function K_{21} to determine sufficiency conditions for spiral behavior of the first kind, i.e., the curve's coordinates $r(t)$, $\phi(t)$, $\psi(t)$ satisfy the following conditions: $r(t) \longrightarrow O$, $O < \phi'' \leq \phi(t) \leq \phi'$, $\psi(t) \longrightarrow \pm\infty$. The conditions are that $K_{21}(r, \phi', \psi) > O$, $K_{21}(r, \phi'', \psi) < O$, K_{31} be nonvanishing for $\phi'' = \phi = \phi'$ and K_1 be bounded away from zero in the same region.

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

Spiral behavior of the second kind, i.e., $r(t) \longrightarrow O$, $\psi(t) \longrightarrow \pm \infty$ and the curve has a definite tangent line, is determined in terms of the functions K_{21} and K_{23}. If in a sufficiently small cone of an integral exceptional direction $\phi = O$, $K_{21} > O$ for $\phi > O$ and K_{23} and K_{32} are nonvanishing for $\phi \doteq O$ then all curves in the cone behave like spirals of the second kind.

To prove a sufficiency theorem on osculating planes at the origin requires conditions on functions K_{21}, K_{31}, and K_{23}. If, in a sufficiently small sector of a cone about the integral exceptional direction $\phi = O$ bounded by planes $\psi = \psi' + \delta$ and $\psi = \psi' - \delta$ one has $K_{23}(O, O, \psi') = O$, $K_{23}(O, O, \psi) > O$ for $\psi' < \psi \doteq \psi' + \delta$, $K_{23}(O, O, \psi) < O$ for $\psi' - \delta \doteq \psi < \psi'$, $K_{21}(O, \phi, \psi) > O$ for $O < \phi \doteq \phi'$ and $\psi' - \delta \doteq \psi \doteq \psi' + \delta$, $K_{31}(r, \phi, \psi' + \delta) > O$ and $K_{31}(r, \phi, \psi' - \delta) < O$ for $O < r \doteq r'$ and $O < \phi = \phi'$, and the solutions are unique in the sectored cone, then every curve in the sectored cone has the exceptional direction $\phi = O$ as its tangent line and $\psi = \psi'$ as its osculating plane.

110 pages. $2.00.

MINERALOGY

AN ELECTRON MICROSCOPE AND A DIFFERENTIAL THERMAL ANALYSIS STUDY OF THE SERPENTINE MINERALS

(L. C. Card No. Mic 58-2232)

Helen Antine Biren, Ph.D.
Columbia University, 1958

About 80 selected specimens belonging to the serpentine family and closely related groups were investigated by electron microscopy, differential thermal analysis, and x-ray spectroscopy. Typical results are illustrated. In the light of these studies and investigations on record, the status of the various members is summarized.

The varieties now classed within the serpentine group may be referred to 3 mineral types, based on particle shapes revealed by the electron microscope, DTA curves, and x-ray patterns:

1. Serpophite, which consists of varieties whose particles are microcrystalline masses with tubular edges, clusters of interlaced tubes, and/or diserete short fairly straight tubes. Chemical formula: $Mg_3Si_2O_7{:}2H_2O$.
2. Chrysotile, which consists of long flexible tubes or fibers. Serpophite and chrysotile are similar chemically; their DTA curves develop an endothermic peak near 700°C., a plateau between approximately 750°C. and 800°C., and an exothermic peak near 820°C.
3. Antigerite, which consists of varieties whose particles are mixed- some similar to serpophite, and lath-shaped, the laths flat, curved, tightly curled into tubes, lamellar or composed of closely packed parallel tubes. Antigerite generally contains less water than serpophite and chrysotile. DTA curves develop an endothermic peak near 760°C., an exothermic peak near 830°C., with no plateau between loops.

The fundamental structure of the group as a whole appears to be tubular, explained on the basis of chemical composition. An explanation offered for the differences in tubular development and crystallinity between serpophite and chrysotile is based on environment of formation, i.e., serpophite forming as a simple hydrothermal or deuteric replacement, while chrysotile formation may involve capillary action and crystallization in fissures. The more complete crystallization of antigorite, the formation of laths (and their tendency to enroll) is explained as the result of shearing stresses, and minor chemical differences.

No clear relationship exists between fundamental particle shape and megascopic habit, and the variation of particle shapes indicates that chemical substitution in the lattice is not homogeneous.

The effect of differences of particle aggregation and curvature on optical properties is discussed.

Specimens with a smaller percentage of microcrystalline aggregates yield spectrometer curves with more and sharper peaks, increasing in number and intensity in antigorite. The broad asymmetrical bands of the serpophite patterns are sometimes replaced by peaks in antigorite patterns.

The differences in shape of the DTA curves are due to higher water content starting reaction at a lower temperature in serpophite. Serpophite subjected to preliminary dehydration yields DTA curves similar to antigorite. X-ray studies of thermal transformations show that both dehydration and reorganization to olivine take place during the endothermic reaction, and that peak temperatures are not critical points marking different phases. Studies of several samples show no amorphous phase during transformation. Temperature and rate of transformation to olivine vary within a comparatively broad and overlapping range in each type, and transformation occurs at a lower temperature in material heated for prolonged periods at constant temperature than indicated on the DTA curve. Material heated for about 14 hours at 500° ± 10°C. reach the stage attained at about 725°C. - 750°C. on the DTA curve. Electron micrographs of samples heated to 1000°C. showed few small particles, and little change in shape of the grosser particles, indicating that the transformation involves only minute migrations within the lattice.

131 pages. $2.00.

AN EVALUATION OF THE COURSE CONTENT OF BASIC MUSIC THEORY IN THE MUSIC EDUCATION CURRICULUM AS DETERMINED BY A JOB-ANALYSIS OF SECONDARY SCHOOL MUSIC TEACHERS IN THE STATE OF OREGON

(L. C. Card No. Mic 58-2340)

George Fremont Boyer, Ed.D.
University of Oregon, 1958

Adviser: Dr. Robert E. Nye

This study is an attempt to evaluate the course content of basic music theory in the music education curriculum as determined by a job-analysis of secondary school music teachers in the state of Oregon.

Through the use of a questionnaire as the chief method of data collection, the respondents were requested to supply information concerning the use they made of various knowledges and skills or abilities which they might have acquired in their own basic music theory courses.

The respondents were classified according to: (1) four geographic areas of the state, (2) the fields of work which they represented, vocal, instrumental, vocal-instrumental, and general music, and (3) the size of school in which they were employed. The data were tabulated in accordance with these classifications and according to total responses.

Generally speaking, the tabulation by geographic areas revealed little variation either from area to area, or from area to the total responses. The tabulation by fields of work revealed slight differences between the ratings of general music teachers and the ratings made by teachers in the other three fields of work.

By their comments, the respondents assigned major importance to training in aural, pianistic, and sight-singing skills in the study of music theory, and by their agreement as to frequency of use, scale intervals, kinds of triads, the construction of the major scale, and the rules of part writing were each given a similar position of importance.

The respondents reported little use of the ability to read or to play figured bass. The responses here were almost overwhelmingly in the rarely or never used columns.

Seven topic headings from music theory textbooks were rated as of minor importance to teachers of music in the public schools on the basis of the use the respondents made of these topics. Those seven were: Neapolitan sixth chord, ninth, eleventh, and thirteenth chords, augmented sixth chords, regular and irregular resolution, chords of the sixth, six-four chords, and secondary dominant triads.

Through the many comments which they made, the respondents asked for less drill and emphasis on the traditional written exercises, and for more situations in which they might use their creative ability.

The criteria for analyses of selected music theory textbooks were formulated from the interpretations of the questionnaire data and the literature. The analyses of textbooks in current use indicated these textbooks may: (1) omit certain phases of music theory training desired by the respondents, (2) by lack of emphasis, attach little importance to certain phases considered important by the respondents, (3) attach major importance to certain phases which the respondents to the study feel are of minor importance.

Certain of the conclusions drawn were:

1. The major portion of the content of music theory courses meets the approval of secondary school music teachers in Oregon.

2. Music theory courses which are a part of the music education curriculum should be re-evaluated in terms of the needs expressed by the professional music educator. More specifically, such re-evaluation should be concerned primarily with the following factors:

   a. the ability to read and to play figured bass is of little practical use to the Oregon professional music educator, and should not be a major element of music theory courses designed to serve him.
   b. music theory textbooks in current use in Oregon do not provide sufficient opportunity for the music education major to become proficient in certain aural, pianistic, and sight-singing skills which are useful in his profession.
   c. music theory textbooks in current use in Oregon include too much emphasis on the type of written exercises which permit little opportunity for the student to develop his creative capacities.

271 pages. $3.50.

WOODWIND QUINTET AND OVERTURE IN C

[WOODWIND QUINTET not microfilmed at the request of the State University of Iowa]

(Publication No. 23,755)

Clyde Earl Johnson, Ph.D.
State University of Iowa, 1957

Chairman: Professor Philip Bezanson

ANALYSIS OF WOODWIND QUINTET

This quintet was written during the spring and summer of 1957. The work consists of three movements marked Allegro con fuoco, Adagio, and Allegro. Elements of classical sonata form have been used in the first movement and of sonata-rondo form in the last, while the second movement is a theme and variations in ternary form.

The first movement begins with a vigorous introduction which establishes the general character of the entire work. Rhythmic motives of the introduction are used in the first theme at bar 14 and are treated developmentally throughout this section. At bar 75, the lyrical second theme appears first in the horn, then in the bassoon and oboe. The

development section begins at bar 107 with a short statement of the introductory material. Fragments of both themes are expanded with free and strict imitation in this section. In the recapitulation, beginning at bar 156, the materials appear in reverse order. A short coda concludes the movement.

In the second movement, the theme and first variation comprise the A portion of the three-part form. The second and third variations (bars 20 through 42) develop the theme in diminution to provide the contrasting B section. The fourth and fifth variations serve as the return of the A section.

Like the first movement, the finale begins with an energetic introduction. The introduction sets forth the basic material of the rondo theme which appears at bar 10. The form of the movement is A B A C B A. The C section draws upon the second theme of the first movement for its material. The composer has attempted to balance the first and last movements in duration and character.

ANALYSIS OF OVERTURE IN C

This overture was written during the fall and winter of 1956. The composer had no program in mind but was rather attempting to combine essentially brilliant thematic materials into a unified structure which adheres to the classical sonata-allegro form. Certain burlesque aspects of the first theme were exploited in the recapitulation in the form of a waltz section at bar 280.

The overture begins with a short introduction (Adagio) that sets the scene for the exposition (Allegro) which commences at bar 11. The first theme consists of two main ideas, both of which draw their motivic structure from the introduction. The first of these begins at bar 11 (cellos and bassoons) and develops into an estinate figure (violins and violas) which serves as an accompaniment to the second idea which enters at bar 38 (bassoons and contrabasses). This idea brings the first theme to a climax in a full orchestral statement at bar 59. A lyrical bridge passage appears at bar 80 (clarinets) and leads to the second theme at bar 113 (trumpet). The theme is based on the material of the bridge passage presented in augmentation. The closing theme occurs at bar 143 in the strings.

The development section begins with a return of the introduction (Adagio) at bar 195. Upon the reappearance of the fast tempo, material from the first theme is treated developmentally.

The recapitulation, beginning at bar 236, presents the themes in their original sequence. The second portion of the first theme takes the form of a waltz upon its restatement at bar 280.

Closing material is used, along with a fragment of the second theme, to form a coda at bar 420 (Presto). The overture closes fortissimo with a full orchestral statement of the head of the first theme.

88 pages. $2.00. Mic. 58-5049

PHARMACOLOGY

SYNTHESIS OF DIPHENIC ACID DERIVATIVES

(Publication No. 22,291)

William Dean Roll, Ph.D.
Purdue University, 1957

Major Professors: Gustav E. Cwalina and
Dale W. Blackburn

The primary purpose of this investigation was to synthesize and characterize diphenic acid derivatives patterned after the structure of chloramphenicol.

A variety of other derivatives of diphenic acid was also prepared during this investigation as plausible modifications of the basic structure became apparent.

The initial problem was to find an efficient method for synthesizing o,o'-Bis(2-N-dichloroacetamido-1,3-dihydroxypropyl)biphenyl. Two approaches were attempted in order to prepare this compound. The first approach consisted of converting o-toluic acid to o,o'-diphenic acid; treating the latter with thionyl chloride to form o,o'-diphenyl chloride and converting this compound to o,o'-Bis(N-methyl)diphenanilide. The Bis(N-methylanilide) was selectively reduced to o,o'-diphenaldehyde with lithium aluminum hydride and this aldehyde was condensed with 2-nitroethanol to form o,o'-Bis(2-nitro-1,3-dihydroxypropyl)biphenyl, sodium salt. Three reducing agents were tried in order to convert the nitro derivative to the corresponding amine: (1) zinc and acetic acid, (2) iron and hydrochloric acid and (3) hydrogen and palladous oxide. We were unable to isolate the free amine base from any of these reactions. The crude amine from the chemical reductions was treated with methyl dichloroacetate in an attempt to prepare o,o'-Bis(2-N-dichloroacetamide-1,3-dihydroxypropyl)biphenyl. In each instance we were unable to crystallize the product. The crude amine from the catalytic reduction was treated with benzoyl chloride to give a crystalline product, o,o'-Bis(2-N-benzamido-3-benxoxy-1-hydroxypropyl)biphenyl.

The second approach consisted of converting either o-toluidine or o-nitrotoluene to o,o'-bitolyl; treating the latter with N-bromosuccinimide to form o,o'-Bis(bromomethyl)biphenyl and converting this compound to o,o'-diphenaldehyde. This aldehyde was condensed with 2-nitroethanol to form o,o'-Bis(2-nitro-1,3-dihydroxypropyl)-biphenyl, sodium salt. Two methods were tried in an attempt to reduce the nitro derivative to o,o'-(2-amino-1,3-dihydroxypropyl)biphenyl: (1) lithium aluminum hydride and (2) hydrogen and palladous oxide. The product from the lithium aluminum hydride reduction was treated with methyl dichloroacetate in an attempt to prepare o,o'-Bis-(2-N-dichloroacetamido-1,3-dihydroxypropyl)biphenyl. We were not able to identify this product.

Three other derivatives of diphenic acid were prepared during this investigation. o,o'-Bis (β-N-dichloroacetamidoethyl)diphenate was prepared from diphenoyl

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

chloride and β-N-dichloroacetamidoethanol; N,N'-Bis-(benzenesulfonyl)-o,o'-diphenoylurea was synthesized from diphenoyl chloride and benzenesulfonylurea; and m,m'-Bis(N-carboxymethyl)diphenamide was prepared from m,m'-diphenoyl chloride and glycine.

Since we were unable to find a suitable procedure for isolating o,o'-Bis(2-amino-1,3-dihydroxypropyl)biphenyl in the free base form, we were not able to obtain o,o'-Bis-(2-N-dichloroacetamido-1,3-dihydroxypropyl)biphenyl in a pure form.

We were able to isolate the amine as the benzamido-benzoyl ester, o,o'-Bis(2-N benzamido-3-benzoyl-1-hydroxypropyl)biphenyl.

Suitable procedures were found for preparing three other derivatives of diphenic acid; namely, o,o'-Bis(β-N-dichloroacetamidoethyl)diphenate, N,N'-Bis(benzenesulfonyl)-o,o'-diphenoylurea and m,m'Bis(N-carboxymethyl)-diphenamide. 87 pages. $2.00. Mic 58-5050

I. COMPARISON OF NOLUDAR (METHYLPRYLON) AND PENTOBARBITAL ON RESPIRATORY MINUTE VOLUME IN RABBITS AND II. SIMULTANEOUS BLOOD ALCOHOL LEVELS AND TOOTHPULP THRESHOLD CHANGES FOLLOWING INTRAVENOUS ETHANOL ADMINISTRATION TO RABBITS.

(L. C. Card No. Mic 58-1626)

Hubert Coleman Stanton, Ph.D.
State University of Iowa, 1958

Chairman: Associate Professor Hugh H. Keasling

I. The respiratory depressant effects of Noludar and pentobarbital alone, and in combination with morphine, were evaluated in rabbits at various equi-depressant dosage levels. The statistical interpretation of the data showed the following results: 1) Noludar 20, 40, 80 and 170 mgm./Kgm. plus 0.608 mgm./Kgm. of morphine produced the same degree of respiratory minute volume depression as Noludar alone. 2) Pentobarbital 7.5 and 10 mgm./Kgm. plus 0.608 mgm./Kgm. of morphine produced significantly more respiratory depression than the pentobarbital alone at these subanesthetic doses. However, pentobarbital 20 and 30 mgm./Kgm. plus 0.608 mgm./Kgm. of morphine was not significantly different from pentobarbital alone.

When simultaneous intermittent injections of equi-depressant doses of Noludar and pentobarbital alone and following morphine pre-treatment were administered, it was found that animals receiving Noludar, either alone or after morphine, survived significantly longer than rabbits receiving pentobarbital with and without morphine pre-treatment.

II. Since the analgetic effect of ethanol has been established clinically but has not been adequately evaluated experimentally, a study of the effect of intravenous ethanol on toothpulp threshold in rabbits was undertaken. Blood ethanol levels were determined and correlated with analgetic effects. It was found that toothpulp threshold change was related linearly to intravenous ethanol dosages of 3, 4 and 5 gms./Kgm.. A statistically significant correlation existed between blood alcohol levels and toothpulp threshold changes at doses of 3, 4 and 5 gms./Kgm.. There is some indication that a minimal blood alcohol concentration is necessary in order to show significant toothpulp threshold changes. Below this blood level no effect on toothpulp threshold occurred.

11 pages. $2.00.

PHILOSOPHY

EXPLICATION AND INDUCTIVE LOGIC

(L. C. Card No. Mic 58-2475)

Frederic Schick, Ph.D.
Columbia University, 1958

This dissertation identifies a mode of philosophical analysis called 'explication,' and evaluates the contributions which various writers believe they have made to philosophy by means of this method.

The first chapter defines explication as the analysis of properties of expressions of an artificial language in terms of other properties of expressions of that language. The aim of this activity is to clarify our understanding of some concept in natural language by reference to some more sharply delineated concept related to it in certain specifiable ways. This mode of clarification is compared to the familiar attempts at clarification by reference to analogies or models. The nature of artificial languages as distinguished from natural ones, and of artificial expressions is also discussed.

The second chapter is concerned with the criteria of the adequacy of an artificial language. To this end, the concept of an artificial paraphrase of a natural sentence is introduced, and the conditions of the adequacy of such paraphrases are discussed. The adequacy of an artificial language cannot be determined in any absolute manner; it is, rather, relative to our accredition of various other elements of a logical system (or 'rational reconstruction') comprising a set of formation rules, a set of semantic rules, a set of paraphrases of natural sentences, and a set of explicata. It is argued that a logical system constitutes an interdependent system which must be accepted or rejected as a whole.

The third chapter is devoted to an analysis of the nature of the criteria for the adequacy of specific explications. These are discussed in the context of an examination of Hempel's articles on the classificatory concept of confirmation -- in particular, in the context of Hempel's various ways of circumventing the paradox he discovers in Nicod's analysis of confirmation. The conditions of adequacy of an explication are formal restrictions on the explicatum

sought drawn from the ordinary use of the concept being explicated. Conditions of adequacy are shown to be necessary but not sufficient conditions for adoption of an explication. Certain further conditions, called 'conditions of preference' must also be met, and some of these are briefly described.

The general points about explication now having been made, the fourth and fifth chapters are devoted to a study of particular instances of explication. The fourth chapter is concerned with current analyses of the concept of degree of confirmation. Carnap's explication of this concept is discussed at length. Two crucial difficulties are given special attention: 1) the various predicates of natural language are not, as Carnap's system demands, definable in terms of primitive predicates, and 2) no satisfactory method for distinguishing primitive from non-primitive predicates has ever been devised. To circumvent the first difficulty, a generalization of Carnap's system is proposed (in which spans of degree of confirmation rather than degrees of confirmation proper are, in general, determined -- Carnap's formulas for degree of confirmation being cases of the span-formulas in which the span is 0). But the second difficulty remains, and effectively precludes the application of any explication based on Carnap's study in any actual context of inquiry. Various other difficulties are discussed. The Kemeny-Oppenheim explication of 'factual support,' the Helmer-Hempel-Oppenheim explication of degree of confirmation, and Popper's explication of that concept are also discussed.

The fifth chapter examines the Hempel-Oppenheim explication of explanation. A broader conception of legality is proposed. Various modifications due to Scheffler are introduced. Goodman's problems concerning projectibility and subjunctive conditionals are discussed, and ways of overcoming them are suggested.

154 pages. $2.05.

PHYSICS

PHYSICS, GENERAL

SOUND PROPAGATION IN FLEXIBLE, POROUS MEDIA

(L. C. Card No. Mic 58-2189)

William Warner Lang, Jr., Ph.D.
Iowa State College, 1958

Supervisor: L. Jackson Laslett

A theory is developed for the propagation of sound waves in a flexible, porous material. An idealized model is constructed, which consists of an array of parallel elastic rods, uniformly spaced in air. Viscous and inertial coupling forces, as well as pressure squeezing accompanying sidewise expansion of the rods, are responsible for interaction between the air and solid of the model. Those mechanisms by which sound energy is converted into heat are of special interest to this study.

A wave equation is derived for plane, longitudinal waves moving through the model with their direction of propagation parallel to the rods. This is obtained from the equations expressing conservation of momentum and mass and the equations of state for the two media of the model. Two dilatational waves are found in the unbounded model. The dimensionless propagation constants for these waves are written in terms of 6 nondimensional parameters, which are characteristic of the material. The expressions for the propagation constants are shown to reduce properly in several limiting cases of physical interest. Work by earlier investigators on rigid, porous media finds expression in this development as one of the limiting cases.

Boundary conditions are introduced by considering first the reflection and transmission of sound at the plane interface between free air and the semi-infinite model. Two expressions are obtained for the acoustic impedance at the interface. One applies when the surface of the model is covered by a thin, massless membrane. The other is valid when the surface is open. The expression for the open-faced impedance is shown to reduce properly in the limiting cases. A second boundary condition is then introduced by considering reflection of energy at the rear surface of a rigidly-backed model which has finite thickness. Expressions for the acoustic impedances at the front surfaces of the open- and membrane-faced models are obtained. A numerical analysis is then carried out on an open-faced model with parametric values which are typical of many real materials.

Measurements of acoustic impedances, flow resistances and porosities of a group of plasticized, cellular materials are discussed. The experimental data on a representative sample are compared with predicted performance. Theory and experiment are found to be in reasonable agreement. It is seen that viscous coupling forces between air and solid are of predominant importance in controlling the amount of energy converted into heat at the internal surfaces of the material. For open-faced materials, viscous effects also determine the amount of energy transferred from the air-borne sound waves to the interior of the solid, where it may be dissipated if internal losses in the substance are appreciable. Inertial coupling is shown to have a lesser effect on the performance of the material. In a systematic study of the behavior of flexible, porous media, the analysis based on a simple model provides a clear understanding of the contribution of each factor to the absorption process.

109 pages. $2.00.

ELECTRONIC PARAMAGNETIC RESONANCE IN IRRADIATED ORGANIC SOLIDS

(L. C. Card No. Mic 58-2294)

Carroll Gene McCormick, Ph.D.
Duke University, 1958

Supervisor: Walter Gordy

The effects of irradiation upon organo-metallic compounds and peptides in the solid state have been studied by means of electronic paramagnetic resonance of the resulting unpaired electron.

The observations were made at X-band frequency using a TE012 transmission cavity and a barretter detector. The absorption was magnetically modulated at 140 CPS. The second harmonic of the modulated barretter signal was phase detected so that the second derivative of the absorption curve was recorded.

The organo-metallic compounds were irradiated with X-rays or ultraviolet at liquid nitrogen temperature and observed at liquid nitrogen temperature. The peptides were X-irradiated at room temperature and observed at liquid nitrogen and room temperature. No resonances have been observed in peptides which have been irradiated by ultraviolet or which have been X-irradiated in liquid nitrogen temperature.

Identification of the free radicals produced by the irradiation is made possible in several cases by means of the proton hyperfine structure. Hydrogen is the only appreciably abundant magnetic isotope in these substances. The hyperfine structure of most of the resonances is ascribed to equal isotropic coupling between the electron spin and the proton spin. In the majority of the resonances the total width of the hyperfine structure indicates that the ls orbital of each hydrogen contributes about 5% to the probability density of the unpaired electron. Equal isotropic coupling of the unpaired electron to as many as eight protons has been observed in X-irradiated acetyl valine.

Most of the resonances in peptides are characterized by lifetimes often as long as several months. This indicates that the free radical is trapped in the solid by means of the lattice of undamaged molecules.

Some of the resonances are quite complex, possibly due to unequal coupling of the odd electron to the protons or to a superposition of the resonances from more than one radical. In many cases the resonances observed at room temperature were quite different from the resonances observed at liquid nitrogen temperature.

77 pages. $2.00.

A DERIVATION OF A COMPLETE SET OF DISPERSION RELATIONS AND AN EXAMINATION OF THEIR PHYSICAL CONTENT

(L. C. Card No. Mic 58-1859)

Richard E. Norton, Ph.D.
University of Pennsylvania, 1958

Supervisor: Dr. A. Klein

The structure of the transition matrices for all processes that can occur for a class of fixed source meson theories is studied. The model consists of scalar meson field coupled to an extended source in such a way that any finite number of quanta can be emitted or absorbed at a given time (multiple vertices), but that all interactions are restricted to be S-wave in nature. The general reaction matrix element for m incident an n emergent particles contains many terms describing sequences of independent processes, which must be removed before one obtains a proper object for studies of a dispersion theoretic nature. It is shown that the ratio of the residual matrix element to a suitable product of source functions possesses those analytic properties, as a function of the total energy of the system, which permit dispersion relations to be stated. Other than for the elastic scattering amplitude the latter make reference to values of the amplitude in a non-physical energy region. In conjunction with a suitably generalized unitarity condition, however, the scheme, when viewed as a set of coupled integral equations, can be solved by successive approximations in terms of a number of arbitrary constants, essentially equal to the number of coupling constants in the original Hamiltonian (actually one fewer). Nevertheless, it is pointed out that the scheme does not admit a unique solution, and this is illustrated physically by exhibiting an extended class of Hamiltonians which yield the same dispersion relations, but which, as a class, contain more coupling constants than make their appearance in the dispersion relations. Physically, it is noted that the solution containing the fewest number of arbitrary constants is the solution for the Hamiltonian whose unperturbed part has a minimum of structure. The additional solutions correspond to the more complicated Hamiltonians and in general exhibit a resonant behavior. These facts are suggested from the form of the Hamiltonians studied and are also verified by direct calculation for the case of two additional theories which can be solved exactly.

85 pages. $2.00.

THEORY OF THE STARK EFFECT IN HYDROGEN AT HIGH FIELDS

(L. C. Card No. Mic 58-2198)

Melvin Hugo Rice, Ph.D.
Iowa State College, 1958

Supervisor: Dr. Ronald Good, Jr.

The quantum mechanical problem of atomic hydrogen in a uniform electric field is treated nonrelativistically. Energy levels and their half widths are determined by using WKB-type approximations to the Schrödinger equation

separated in parabolic coordinates. The approximation method used gives a description of the behavior of the energy levels over a greater range of energies and field strengths than previously considered. In particular, it gives a more nearly complete description of the energy levels over a wider range of field strengths than it is possible to obtain from a perturbation theory approach.

Formulas in terms of complete elliptic integrals are given for calculating energy levels and half widths as a function of field strength up to the point of disappearance of the effective potential barrier which hinders ionization of the atom by the external field. At low fields the approximate method yields results in excellent agreement with perturbation theory; at high fields the method has been checked by a direct numerical integration of the separated Schrödinger equation.

An improved expression is derived for the lifetime against ionization by the electric field. Previous derivations of the lifetime fail to take into account certain two-dimensional aspects of the problem. 74 pages. $2.00.

TOPICS IN DISPERSION THEORY FOR MAXWELL FIELD AND NONRELATIVISTIC PARTICLES

(L. C. Card No. Mic 58-2227)

David Yue Wong, Ph.D.
University of Maryland, 1958

Supervisor: Professor John S. Toll

Several topics in dispersion theory for Maxwell field and nonrelativistic particles are investigated. In the case of the Maxwell field, the principle of strict causality is first applied to the derivation of dispersion relations for scattering matrix elements. The result is that the imaginary part of each matrix element, with a given angular momentum quantum number, is determined by the real part of the complete scattering matrix plus all low energy limits. Together with the unitarity condition, a formal iterative procedure can be set up to obtain a solution of the dispersion relation from the low energy limits. This solution is shown to be identical with the physical solution when the validity of the usual perturbation expansion in a coupling parameter and the convergence of all integrations and sums are also assumed. Next the dispersion relation for fixed momentum-transfer amplitudes is derived. These amplitudes are defined through a power series expansion in the momentum-transfer. The power series converges for all frequencies. This convergence is assumed to be uniform in order to justify the analytic behavior that leads to the dispersion relation. The second part of this investigation deals with potential scattering of nonrelativistic particles. Dispersion relations are derived under a weaker causality principle, namely, the requirement of the out-going wave Green's function for the Schrödinger equation. However, the additional assumption of a velocity independent potential with certain integrability is also necessary in the present derivation. When bound-states are absent, all scattering matrix elements and fixed momentum-transfer amplitudes satisfy the same dispersion relations as for the scattering of light. Furthermore, a somewhat stronger dispersion relation is also satisfied due to the assumption of the integrability of the potential. This makes possible the determination of the complete scattering matrix from the Fourier transform of the potential using the dispersion relations. When bound-states occur, all dispersion relations are modified to include residues from poles on the upper half of the complex momentum-plane. Several applications of dispersion relations are given throughout the text. Some implications of further relaxations of the causality principle are discussed near the end. 97 pages. $2.00.

ON TRANSPORT THEORY OF RAREFIED GASES

(L. C. Card No. Mic 58-2315)

Sigi Ziering, Ph.D.
Syracuse University, 1958

Supervisor: Eugene P. Gross

In the kinetic theory of gas, the Chapman-Enskog solution of the Boltzmann equation provides us with an adequate description of the state of a gas several mean free paths from physical boundaries, provided the density, flow velocity, and temperature gradients are not too big. It also gives values of transport coefficients related to diffusion, viscosity, and heat flow. This solution, however, fails to give us a description of the gas in the immediate vicinity of the physical boundary, where the gas and boundary interactions result in large temperature and flow velocity gradients within a few mean free paths. The Chapman-Enskog solution is only valid in a Clausius gas where d, the relevant dimension of the body, is much larger than λ, the mean free path of the molecules.

Recently, there has been much concern with the problems of obtaining solutions for transport phenomena that are applicable for an arbitrary ratio of the Knudsen number (d/λ). Methods used to data involve approximating the distribution function, $f(\vec{v},\vec{x},t)$, by polynomials, over the entire velocity space; the distribution function is assumed to be continuous. A large class of problems in the kinetic theory of gases are to be solved by imposing microscopic boundary conditions (specification of the distribution function at the wall). Investigation shows that the distribution functions are discontinuous near a boundary for $v_x = 0$. The expansion of the discontinuous distribution function into polynomials orthogonal over the entire velocity space, leads to very poor convergence and inaccurate values for the observable properties of gases.

In order to overcome these difficulties, we treat $f(\vec{v},\vec{x},t)$ separately for $v_x > 0$ and $v_x < 0$. This allows for the exact incorporation into the solution of the discontinuities inherent in boundary conditions, without recourse to any step function approximation, as in a velocity expansion for $-\infty < v_x < \infty$. At the same time, the solution has the distinct characteristics of two non-interacting particle streams that we expect to find in free molecular flow phenomena extreme Knudsen gas). An approach based on this half-range formalism is presented for linearized solutions of the Boltzmann equation. Two problems in kinetic theory are analyzed in detail; the heat flow and viscous flow between two parallel plates. Results are obtained in low approximations, and comparisons are made with the

Chapman-Enskog type of solution, as well as with the more recent expansions in full-range velocity polynomials. There is a definite improvement in the solution in the Knudsen gas and boundary layer region. Comparing our results for a Clausius gas with the results obtained by Chapman and Enskog, we find agreement within 7% between our second approximation and their result for the coefficient of viscosity. While the solutions obtained are quite general for any inverse law of force of interaction, specific results are obtained for particles interacting as hard spheres. Our results are exact in region $d/\lambda << i$ (Knudsen region). 94 pages. $2.00.

PHYSICS, METEOROLOGY

LARGE-SCALE VERTICAL MOTION AND SUMMERTIME PRECIPITATION

(L. C. Card No. Mic 58-2280)

Robert Charles Curtis, Ph.D.
The Pennsylvania State University, 1958

An investigation of the relationship between large-scale vertical motion and the frequency of the convective type of precipitation (thunderstorms and showers) was undertaken in order to test the hypothesis that such motion exerts a controlling influence upon the cloud convection that produces this precipitation.

The investigation was carried out in the eastern United States, and for the first twenty days of July 1955. Two types of vertical velocities were used: Computations, from the initial conditions (at 1500Z each day), by the Joint Numerical Weather Prediction Unit, Washington, D. C.; and computations made by a kinematic method from the relation $W_h \approx -\text{div} \int_s^h \nabla \, dZ$.. These latter computations were made at two times during each day, 0300Z and 1500Z.

The results of the investigation supported the hypothesis, in that the large-scale vertical velocities computed by the kinematic method were found to be very closely related to the frequency of thunderstorms at night. It is not, however, well related to the frequency of showers at night or during the day. During the day the inter-action between the effects of vertical velocity and the effects of heating greatly reduces the relationship between vertical velocity and the frequency of thunderstorms.

The two types of vertical velocities used were found to be completely different. This difference is attributed to the neglect, by the Numerical Weather Prediction techniques, of momentum exchange between the earth's surface and the overlying air. The principal vertical velocities occurring in the normal summer synoptic conditions were found to be the result of a diurnal variation of this exchange of momentum. These velocities are characterized by an oscillation of direction having a twenty-four hour period, imposed by the diurnal cycle of heating and cooling at the earth's surface.

The relationship between the frequency of convective precipitation and other factors that are generally considered to influence cloud convection was investigated in order to determine the relative merits of the kinematic vertical velocity as a predictor of the probability of convective precipitation. The lapse rate and the mean relative humidity of the 900 to 700 mb. layer, and two stability indices, each of which combines a lapse rate and a relative humidity parameter, were used for this purpose.

Of these four parameters, the kinematic large-scale vertical velocity was found to be the best single predictor of the probability of thunderstorms at night. A combination of vertical velocity and stability index or of vertical velocity and 900 to 700 mb. lapse rate was found to be a somewhat better predictor of thunderstorms at night than the vertical velocity alone. The mean relative humidity of the 900 to 700 mb. layer was found to be the best single predictor of the frequency of showers, both day and night, and especially during the day. It also is the best single predictor of the frequency of thunderstorms during the day.

It was concluded that large-scale vertical velocity does exert a controlling influence upon cloud convection, but that it is not the only factor that does so. The cycle of daytime heating and nocturnal cooling (over land areas), and the moisture content of the air are also controlling factors of considerable importance. These factors, however, are not independent of vertical motion.

112 pages. $2.00.

PHYSICS, NUCLEAR

PARITIES AND ANGULAR MOMENTA OF THE EXCITED STATES OF Cd^{114}, Nd^{144}, AND A^{38}.

(L. C. Card No. Mic 58-1760)

Joseph Neale Brazos, Ph.D.
Purdue University, 1958

Major Professor: Rolf M. Steffen

Polarization-directional correlation measurements on gamma-gamma cascades have formed a useful tool in determining the parities and spins of the nuclear states involved and in checking certain theories regarding these quantities.

The polarization of one of the gamma rays with respect to the angle between the two can be explored by making use of the polarization sensitivity of Compton scattering according to the Klein-Nishina formula.

The purpose of this investigation was the determination of the polarizations in order to obtain information on the parities and spins of the isotopes Cd^{114}, Nd^{144}, and A^{38}.

The results of the polarization-directional correlation measurements on the two gamma rays of Cd^{114} show that all three states have the same parity, and furthermore give confirmation to the 4(Q)2(Q)0 assignment. The 2-2-0 scheme with a mixture in the first transition has been ruled out. Directional correlation results are in agreement with the polarization information. Hence the K-capture decay in In^{114} which precedes this gamma-gamma cascade must originate in the 50-day isomeric state of In^{114} with I = 5+ and not in the 72-sec ground state with I = 1+. Observations on the gamma radiation directly

following the decay of the 72-sec state produced by deuteron bombardment of cadmium foils in the Purdue cyclotron confirmed this result.

The polarization correlation results on the Nd^{144} cascade indicate that a negative parity is to be assigned to the second excited state. The data also give some evidence of a positive parity for the intermediate state. A 1-(E1)2+ (E2)0+ scheme is therefore proposed for this isotope. No strong conclusions can be drawn concerning the amount of admixture in the upper transition from the polarization results. The results are in reasonable agreement with those from previous polarization studies.

Measurements on the combined radiations of the A^{38} cascade and on the upper transition only indicate that there is an over-all parity change and that a parity change in the upper transition is likely. The assignment 3-(99.9% E1 + 0.1% M2)2+(E2)0+ is the only scheme in agreement with all information concerning this decay.

All of the above results lend substantial support to both the Goldhaber-Sunyar and Talmi-Glaubman rules.

Certain points concerning experimental technique and data reduction methods are brought out, and, in particular, a discussion of the effective triple coincidence resolving time for the arrangement used is presented.

84 pages. $2.00.

HYDRODYNAMICAL THEORY OF SPONTANEOUS FISSION WITH APPLICATIONS TO MENDELEVIUM

(L. C. Card No. Mic 58-2377)

William Douglas Foland, Ph.D.
The University of Tennessee, 1958

Major Professor: R. D. Present

The half-life for the spontaneous fission of Mendelevium is obtained by using the liquid-drop model. The drop is assumed to be incompressible and to have uniform mass and charge densities. The velocity field for the drop undergoing fission is assumed to be irrotational. The surface of the drop is assumed to be given by

$$r = R(\mu) = 1 + \sum_{n=0,\ \text{even}} a_n P_n(\cos\theta) .$$

Mendelevium should have only slight stability against deformations of the P_2 type: its x-value is ~ 0.84. (x is defined for the spherical drop as $x \equiv \frac{1}{2}\frac{\text{electrostatic energy}}{\text{surface energy}}$; when x = 1, the drop is unstable against a small P_2 deformation.) It is assumed, then, that a_2P_2 is the only important member of the sum for $R(\mu)$ and that power-series methods will give good approximations to quantities needed in the calculations. The barrier to fission is assumed to be a function of a_2 and not of the other a_n; terms through a_2^8 are used in the series for the barrier. The kinetic energy of the drop is obtained as a function of a_2 and $\dot{a}_2$ --ignoring the other values of n --; terms through a_2^4 are obtained for the kinetic energy.

Two new liquid-drop calculations are made:

(1) The kinetic energy for the drop is evaluated through the a_2^4 th term in the power series.

(2) A particular contribution to the electrostatic energy of distortion is evaluated through the general seventh-power term in the a_n's. This contribution is the one made by those regions causing difficulty in the limits of integration when one expands $|\vec{r} - \vec{r}'|^{-1}$ in evaluating the electrostatic energy of the deformed drop.

Because of uncertainties in x, the value of x is used as a parameter. The choice of x is made to give a barrier height agreeing with extrapolations of empirical activation energies. (The process demands a 2% increase in the value of x.) Half-life estimates for Mv range from 10^{-1} to 10^3 sec (there are calculational uncertainties which prevent a fixed, definite estimate); the experimental value is $3\frac{1}{2}$ hours.

138 pages. $2.00.

ENERGY AND ANGULAR DISTRIBUTIONS OF PHOTOPROTONS FROM NITROGEN-15

(L. C. Card No. Mic 58-1865)

Jacob L. Rhodes, Ph.D.
University of Pennsylvania, 1958

Supervisor: Dr. W. E. Stephens

Nitrogen gas, enriched 95.7% in the isotope N^{15}, was exposed to betatron bremsstrahlung of 18.7 and 24.6 Mev maximum energy, and the photoprotons resulting from the reaction $N^{15}(\gamma, p)C^{14}$ were detected in nuclear emulsions. The energy and angular distributions of the protons were determined as were the photoproton yield and cross section. The yield with 18.7 Mev bremsstrahlung was 2.06 ($\pm$.3) x 10^4 protons/atomic weight/roetgen, while the yield with 24.6 Mev bremsstrahlung was 1.06 ($\pm$.14) x 10^5 protons/atomic weight/roetgen. The integrated cross section from threshold up to 24.6 Mev for photoprotons in which the residual nucleus is left in its ground state was 14.5 ($\pm$1.5) Mev-mb, while the integrated cross section over the same energy range for transitions in which the residual nucleus is left in excited states was 24 ($\pm$5) Mev-mb, giving a total photoproton cross section over this energy interval of 38 ($\pm$5) Mev-mb. In addition to the "giant resonance" extending from 19 to 24 Mev with integrated cross section equal to 10.3 Mev-mb the cross section vs. photon energy curve for ground state transitions shows small peaks at 11.6 Mev, at 15 Mev, and at 18.6 Mev, with integrated cross sections of 0.80, 1.47, and 0.75 Mev-mb respectively. A narrow peak at 20.5 Mev. in the "giant resonance" region has an integrated cross section of about 0.5 Mev-mb.

The angular distributions of the various proton groups fit curves of the form $A + \sin^2\theta\,(1 + \beta\cos\theta)^2$. The asymetry coefficient is approximately equal to 0.3. For protons of energy less than 9 Mev, the ratio A/B is found to be consistent with calculated distributions of protons emitted from isolated energy levels in the target nucleus. For protons of energy greater than 9 Mev a predominantly $\sin^2\theta$ distribution was found; the reduced isotropic component observed in the angular distribution of these protons is attributed to interference in s-wave and d-wave protons emitted from overlapping states accessible by electric dipole absorption in N^{15}.

119 pages. $2.00.

KINETICS OF DISTRIBUTION OF VARIOUS SUBSTANCES IN ENDOTOXIN-PRODUCED SHOCK

(L. C. Card No. Mic 58-2168)

Joe Bradley Aust, Ph.D.
University of Minnesota, 1958

The kinetics of distribution of Cr^{51} tagged red blood cells, I^{131} tagged albumin, sucrose or thiocyanate, and D_2O or antipyrine were studied simultaneously in blood and tissues of normal and endotoxin shocked dogs over a 2-hour period while monitoring arterial, venous, and portal pressures. This kinetic study was designed to give information regarding the blood flow to the various tissues, the rate of uptake of the various labels by these tissues, and, of particular interest, any pooling of fluid in a given tissue and the nature of the pooled component.

The tagged substances were injected into normal and endotoxin shocked dogs. Samples of blood and biopsies of skin, muscle, intestine and liver were taken at 2, 5, 15, 30, 60 and 120 minutes following the injection of tagged materials. The samples for radioactive assay were counted in a well-type scintillation counter immediately and again at 30 days. The differentiation of I^{131} from Cr^{51} was made by calculations from the differential decay rates over the 30-day period. Similar samples of blood and tissues for determination of D_2O, sucrose, thiocyanate, and antipyrine content were assayed for their respective tags. Estimation of tissue blood flows were calculated by assuming flow limitation for D_2O distribution in the first two minutes and applying the Fick principle. The dosage of endotoxin was one which previous studies had shown to produce irreversible shock in 100 per cent of dogs in 6 hours. Five dogs administered tags alone served as controls for five dogs given the same tags following the administration of E. coli endotoxin.

During the normal kinetic studies no significant changes occurred in the arterial blood pressure, central venous pressure, or portal venous pressure over the 2-hour period of observation and sampling of tissues. The administration of E. coli endotoxin was followed by a precipitous fall in arterial blood pressure to levels of 30 to 40 mm Hg, reaching a minimum in 3 to 5 minutes. Portal pressure rose to a level of from 2 to 4 times normal and remained high for 10 to 15 minutes, then returned and remained at pre-injection levels. Central venous pressures remained relatively constant.

In the normal studies, liver and intestine were found to have high flow rates and pick up the water and extra cellular tags very rapidly from the blood. Of the tissues studied skin equalibrated the most slowly, requiring the full 2 hours. Liver had the largest space for both red blood cells and plasma, although its flow rate was apparently not higher than that of the intestine. There was virtually no sucrose space in the intestine, indicating that enzymes present there probably metabolized this sugar and made its use as an extracellular tag in this tissue valuless.

In the endotoxin-shocked animals, the sequestration of the plasma tag in the intestine, amounting to a 3-fold increase, was the most striking change. There was no concomitant increase in the red blood cell tag and the intestinal tissue hematocrit fell to as low as 7 per cent. Significant increase in the water and extra cellular tags were also obtained in the endotoxin shocked intestine. Perfusion rates of all tissues were markedly decreased, and D_2O equilibrium between blood and tissues failed to take place during the 2-hour observation period.

54 pages. $2.00.

I. THE PARTICIPATION OF CHLOROPHYLL AND PHYCOBILINS IN THE PHOTOSYNTHESIS OF RED ALGAE. II. OBSERVATIONS ON CELLULAR STRUCTURES OF PORPHYRIDIUM CRUENTUM.

(L. C. Card No. Mic 58-1686)

Marcia Brody, Ph.D.
University of Illinois, 1958

A culture medium for Porphyridium cruentum consisting of distilled water and inorganic salts, is specified. The organism grows freely in this medium (the higher light intensities used in this work gave increases up to 40 fold in 6 to 8 days), and the growth is not clumpy. The cells are homogeneously dispersed in the medium and therefore suitable for quantitative physiological experiments.

Cells with different proportions of phycobilins to chlorophyll were obtained by growing cultures in light of various wave lengths, or in white (fluorescent) light of different intensities. A 2.82 fold change in pigment ratio resulted when cells were grown in blue light (436 mμ) of 1.16×10^4 ergs/cm^2/sec, and green light (546 mμ) of 2.49×10^4 ergs/cm^2/sec). Data are presented which indicate that much greater ranges in pigment proportions could be obtained by culturing cells in monochromatic light of widely differing intensities (0.0096 to 18.3×10^4 ergs/cm^2/sec). It was found that both complementary and non-complementary chromatic adaptation could be induced by culturing in certain combinations of wave length and intensity. Adaptation was complementary at lower light intensities (10-10^2 ergs/cm^2/sec), and non-complementary at higher light intensities (10^4-10^5 ergs/cm^2/sec). It is suggested that the level of concentration of a pigment depends upon two rates – that of photochemical formation of the pigment from its precursor, and that of its photochemical destruction, probably by photoxidation; the former being greater at low light intensities, the latter being greater at high light intensities.

Measurements of quantum yield have shown that chlorophyll, at lowest possible estimate, has a photosynthetic efficiency greater than that of the phycobilins (at least at wave lengths shorter than 644 mμ). These efficiency

determinations were made with totally-absorbing suspensions, an improvement over earlier determinations with cell material which transmitted appreciable fractions of the incident energy. The scattering of light by cell material leads to uncertainty in the measurement of the transmitted fraction, and therefore to uncertainty in the amount of energy absorbed.

It was found that wave lengths longer than 644 mμ are beyond the range of maximum efficiency of chlorophyll, so that measurements made in this region are not truly representative of its efficiency.

The results of these measurements have made it unnecessary to suppose that in red algae the phycobilins could be the photochemical sensitizers of primary importance. Our comparisons of the assimilation time T_A, also afford some support for the hypothesis that chlorophyll is the direct or immediate sensitizer for the photochemical process in red algae.

Pigment proportions did not seem to be the factor of primary importance in determining the quantum yield in the spectral region where phycoerythin was absorbing most of the total absorbed light (546 mμ) - although it may be the controlling factor under other circumstances. It was found that the yield at 546 mμ could be altered by prior exposure for short periods of time (2-3 hours) to light of certain wave lengths. Such exposures did not alter the proportions of pigments. Exposure to red or blue light, both absorbed primarily by chlorophyll, reduced the yield at 546 mμ, while exposure to green light, absorbed primarily by phycoerythrin, promoted development of full photosynthetic efficiency in the green region. The results of the present study suggest that the yield in the region of chlorophyll absorption is relatively constant, while that in the region of the absorption maximum of phycoerythrin is subject to great modification in short periods of time.

The cellular structure of Porphyridium cruentum was studied with both light and electron microscopes. The photosynthetic plastid in this red alga was found to be structurally similar to that in the Chlorophyceae and higher green plants. The phycobilins, as well as the chlorophyll, seem to be associated with the lamellae of the plastid. High light intensity leads to production of cells in which the parallel arrangement of the lamellae, characteristic of cells grown in moderate light, is disrupted – due to a high degree of vacuolization in the interlamellar matrix. Other cell structures (nucleus, pyrenoid, etc.) are described. 131 pages. $2.00.

EFFECT OF SHEAR ON PENICILLIN MOLD

(L. C. Card No. Mic 58-2442)

John Dewain Gabor, Ph.D.
Cornell University, 1958

The effect of shear on penicillin mold is not only of interest to the fermentation industry but also to those studying the cancer problem. The fermentation industry in the use of agitated fermentation vessels has to have a balance in agitation to produce sufficient aeration without damaging the cells. Concern is also in the factors influencing the cohesiveness of cells. It is believed that the rate of cancer spread is related to cell cohesion.

Penicillium chrysogenum (#284 Univ. of Ill.) was the particular strain studied in this investigation. The destruction of the mold was studied under controlled shear conditions using a device which consisted mainly of a disk rotating above a stationary disk. The disks were constructed so that the shear occurred only at the outer periphery of the disks. The shear disks were mounted in a high speed drill press. The speed of the rotating disk and the distance between the disks could be varied.

There are two aspects to the destruction of the mold: one is the injury to the cells, and the other is the breakdown of the clumps formed by the collective growth of the cells. The cell destruction was measured by the amount of protein leakage with the biuret colorimetric test. The clump destruction was followed by measuring the fluctuations in light transmission of the mold suspension flowing through a transparent channel.

The mold was grown in 1000 ml Erlenmeyer flasks on a rotary shaker fermenter. The mold was washed of its growth medium and suspended in a 0.75% NaCl solution. The suspended mold was passed through the shear device operating at rates of shear of 4,900 to 22,200 sec^{-1}.

It was found that the extent of destruction to both the cells and the clumps depended upon the time the mold was in the shear field and the intensity of the shear field. The clumps broke down until they reached a particular size which the shear field could no longer reduce. This ultimate clump size was a function of the rate of shear. Although the ultimate clump size was independent of the initial average clump size of the mold suspension, the rate at which the clumps broke down was dependent upon the initial clump size. Large initial clump sizes resulted in high rates of degradation. Just as the clump size attained a definite ultimate in breakdown so did cell destruction reach a terminal point. It appeared that cell injury occurred only when the cell was attached in the clump, for when the ultimate in clump destruction was reached, the ultimate in intracellular leakage was also reached. High rates of clump destruction, therefore, resulted in high rates of protein release.

The effects of the pH of the mold suspension and the composition of the growth medium on the strength of the mold was investigated. It was found that the pH of the suspension in the range of 5.2 to 7.4 did not affect the strength of the mold. The calcium in the growth medium had an influence on the cell cohesiveness. Calcium-deficient cells were much weaker than mold cells grown with calcium.

The average clump size of mold growing during the period from 24 to 72 hours did not change with time. However, the rate at which the average clump size was reduced by shear decreased with increasing age of the mold. Because of increasing concentration of mold in the suspension with age, the rate of protein release increased.

The breakdown characteristics of the mold in a Waring Blendor were similar to those in the shear disks. The blendor produced a very small ultimate clump size because of its high rate of shear. The mold was also subjected to the shear of a small stirred fermenter. It was found that here, too, an ultimate in clump size was attained. The shear in the fermenter was very mild compared to that developed in the shear disks.

143 pages. $2.00.

TRACER STUDIES ON BONE MINERALIZATION IN THE DEVELOPING CHICKEN EMBRYO

(L. C. Card No. Mic 58-2426)

David Alvin Libby, Ph.D.
Michigan State University, 1955

The embryonate egg and the young chick were used to determine the effects of various compounds on the uptake and distribution of radio-active calcium. In an attempt to interfere with calcium supply, the complexing agents, boric acid, citric acid and ethylenediamine tetra acetic acid were used. Anti-vitamins for panththenic acid, pyridoxine and biotin were utilized to impair the metabolism of ground substances, and the hormones glucagon and insulin were employed to alter the energy supply to the developing bone.

The Ca^{45} complexed with boric acid, sodium citrate or EDTA has an increased mobility. This was indicated by more rapid uptake, transport and turnover of the tracer. In general, all tissues with the exception of the yolk sac contained greater quantities of Ca^{45}; the femur content was consistently doubled by these treatments. Yolk deposition of the isotope was prevented to a large extent by injections of these compounds, thereby making more of the tracer available to the skeletal structures. In addition, these treatments caused greater quantities of Ca^{45} to be returned to the gut for possible excretion. The Ca^{45} of embryonic excreta is recirculated, to a greater extent if complexed, making the isotope repeatedly available to the embryo.

Inhibitory vitamin analogues had little or no effect on embryonic bone uptake of Ca^{45}. Pantoyl taurine produced results similar to that of the complexing agents, but to a much less marked degree. Statistically significant differences from control values were never obtained with any of the analogues. The results indicate that the use of the specific vitamin inhibitory analogues did not produce deficiency conditions in the embryonate egg which are observedly similar to the deficiency conditions produced by maternal dietary deficiencies of pantothenic acid, pyridoxine or biotin.

Glucagon was consistently effective in reducing the Ca^{45} content of embryonic and young chick bones. This probably was not the result of a reduction of glycogen at the site of active calcium deposition. As in the case of the complexing agents, lesser quantities of the isotope were deposited in the yolk sac. Excretion of Ca^{45} may have been enhanced by glucagon injections. Insulin exerted no apparent effects on the Ca^{45} content of bone. Since calcium deposition was normal additional glycogenesis at the site of mineralization will not increase deposition of calcium. 116 pages. $2.00.

A SPECTROPHOTOMETRIC INVESTIGATION FOR ENZYMES CONTAINING IRON-PORPHYRINS IN THE PLASMODIUM OF THE SLIME MOLD PHYSARUM POLYCEPHALUM

(Publication No. 22,646)

Newell A. Younggren, Ph.D.
University of Colorado, 1956

Supervisor: Associate Professor Charles H. Norris

Among the important problems in the field of biology are those having to do with cellular respiration. The oxidation process may be completed by the removal of electrons, the removal of hydrogen or by the addition of oxygen. The primary oxidation of a given substrate is accomplished by the removal of two hydrogen atoms (two hydrogen ions and two electrons) through the action of a specific dehydrogenase. Investigations, in the last fifty years, indicate that the transfer of these hydrogen atoms (ions and electrons) to the oxygen forming water or hydrogen peroxide is accomplished through a system of enzymes. Among the common transfer mechanisms are the iron-porphyrins, referred to by Keilin (1925) as cytochromes.

The slime mold Physarum polycephalum was chosen for this investigation for three reasons: 1) because of its availability, and ease in culturing; 2) because of its rapid development, and apparent increased metabolism in streaming or plasmodial stage; and 3) because of the controversy as to whether or not cytochromes are present as the enzyme transfer system in the plasmodial stage.

Spectrophotometric identification of the cytochromes has been made in many living organisms. However, it was advisable because of the "masking effects" and general sensitivity of the spectrophotometer, to pursue a system of extractions. Two tested extraction methods were chosen, the hot acetic acid process of Goddard (1944) and the water homogenate procedure of Augenfeldt (1954), unpublished).

One hundred samples were ultimately extracted, fifty by one method and fifty by the other, and these materials analyzed through the range of the visible spectrum. Particular attention was given to the absorption bands of cytochrome c, both in the reduced (5507, 5223, and 4150 Angstrom units) and the oxidized (5300, and 4000 Angstrom units) state.

Absorption spectra were plotted in order that a more complete picture be obtained. The graph results indicated that the cytochromes were not present in the plasmodium. Portions of the original samples had been lyophilized and several of these (showing aberrant graphs) were placed in solution and analyzed after being treated with known iron-porphyrin inhibitors (cyanide, azide, etc.) as well as with reducing and oxidizing agents. Graphs of the results of these check-test samples were made and corroborated the original findings by being negative.

The negative results from this study may have been due to the inability of the extractive methods to separate the cytochrome from its complex protein. This would mean that the supernatant fluid did not have the cytochromes, but that they were (if they exist) left in the residue.

Should one assume, as one logically might that the cytochromes are not involved in the respiratory activity of the plasmodium, what other substances could act in the transfer capacity? It is suggested that investigations be made on the flavoproteins as well as upon the enzymes inhibited by iodoacetate. Further consideration should be

made of the glutathiones, Vitamin B_{12}, and the copper enzymes. It is not impossible to have transfer mechanisms other than cytochromes. Several authorities (Stiles, 1946), (Wolf and Wolf, 1947), (Eschenberg, 1950) (Ward, 1955) have indicated such to be the case.

64 pages. $2.00. Mic 58-5051

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

THE DEVELOPMENT OF LOCAL GOVERNMENT IN PALESTINE: BACKGROUND TO THE STUDY OF LOCAL ADMINISTRATION IN ISRAEL

(L. C. Card No. Mic 58-2463)

Edwin Emanuel Gutmann, Ph.D.
Columbia University, 1958

Local government in Israel today has been molded by three distinct and often contradictory trends. The first of these is the tradition of the patriarchal, Oriental society as it had developed in the Ottoman Empire. This included the millet system of self-rule of religious minorities, by which the individual was affiliated with a governmental machinery by virtue of his faith or nationality, rather than his geographical location.

The second was the system of self-rule of the Jewish villages which were established in Palestine after the eighteen-eighties with the beginning of the modern Zionist movement. The same democratic spirit later animated public life in the Jewish cities and the Jewish quarters of the cities with mixed Arab-Jewish population. The actual governmental structure of the Jewish localities cannot be related to previous experiences of self-rule in the diaspora (the countries of the Jewish dispersion), and it was the result of ad hoc arrangements. It was based on democratic principles prevailing in the West and thus worlds apart from the conditions prevailing in the Arab villages.

The third trait was that of the foreign ruler over the country: at first the Ottoman Empire and then, for thirty years, the British Mandatory Government. From the middle of the nineteenth century, in the era of reforms (tanzimat), the Ottoman imperial administration attempted to recoup its powers throughout the provinces. This amounted to the imposition of an alien (French) model of provincial and local administration on the framework of the old patriarchal society. The British ruler did not basically change the administrative structure at the local level, but elaborated legislation and codified, and added one new form of local authority. The endeavor of the British to enforce strict equality between the two major communities in the country and keep the status quo failed, and in the second half of their rule and particularly after the Report of the Palestine Royal Commission of 1937, each community was openly invited to go its own way in local government.

The second of these three has been most influential on present-day local politics in Israel, but it was the first which largely dominated the third. The legal structure as it emerged from the Ottomans and the British was taken over by Israel and very few basic changes have so far been introduced into it.

Part One of this study describes the system of local and communal self-rule in the last fifty years of the Ottoman rule over Palestine. The provisions of the laws of provincial and municipal administration, and their actual operation in the country are analyzed, as well as the part played by the millet system in providing governmental services. The last chapter relates in detail the self-rule as it developed in the Jewish villages.

Part Two deals with the five stages of local government policies and practices under the British, from the early days of the Military Administration to the end of the Mandate. This is set against the background of British policy toward local government in colonies in general, the "stepping stone" theory of gradual advancement from local to national self-rule. The rest of this part is in a sense a case study to evaluate that policy in the setting of a colonial plural society. Local politics throughout the Mandate were but one link in the national struggle of the two communities in Palestine. The legislation enacted by the Mandatory Government is reviewed, with particular attention paid to the major enactment, the Municipal Corporations Ordinance of 1934. The highlights of local politics were the elections of 1927, 1934/35 and 1946/47, as well as the inter-communal conflicts in the mixed cities, and particularly in Jerusalem. The Jewish community added to this country-wide local government system a network of "national" institutions of its own, which caused frequent friction between the two competing sets of self-rule. This cut across the rather severe internal struggle for power within the Jewish community between the Left and the Right, in which the Left gradually seized control of the "national" institutions, whereas the Right became entrenched in the Jewish cities and bigger villages.

The emphasis in this study is throughout on those aspects which have molded the present local government in Israel.

316 pages. $4.05.

THE CANADIAN PRIME MINISTERS 1867-1948: AN ESSAY ON DEMOCRATIC LEADERSHIP

(L. C. Card No. Mic 58-2448)

Steven Muller, Ph.D.
Cornell University, 1958

This study reviews the careers of the eleven men who served as prime ministers of Canada between 1867 and 1948. It assumes that justification for general observations concerning the nature of democratic leadership emerges from their experiences. The general problem of leadership in democratic politics is considered in an initial section. There follows an examination of the Canadian political setting in 1867. The record of the successive prime ministers is then examined in detail, with particular reference to career preparatory to premiership, leadership of party and ministry, relationship with Governors-General, and conduct of over-all policy. A concluding section provides comparative evaluations.

The three most successful premiers during the period

were John Alexander Macdonald, Wilfrid Laurier and William Lyon Mackenzie King. Their conceptions and execution of national political leadership are discovered to be remarkably similar. Macdonald's evolution of the National Policy and his sponsorship of the Canadian Pacific Railway; Laurier's adoption of the National Policy and his conduct during the first World War; and King's handling of the constitutional crisis of 1926, his pre-war foreign policy, and his war leadership provide particularly significant and detailed illustrations.

A clear contrast is seen between the conceptions and performance of these three men and the approach to leadership taken by such relatively less successful prime ministers as Alexander Mackenzie, Arthur Meighen, and Richard Bedford Bennett. Development of this contrast is further extended by a review of the prime ministership of Robert Laird Borden, whose concept of leadership changed radically while he held office. The need for a positive exercise of the leadership function is illustrated by the events following the death of Macdonald, when John Abbott, John Sparrow Thompson, Mackenzie Bowell and Charles Tupper served as premiers in rapid succession.

Macdonald, Laurier and King exhibit in common a pragmatic, non-doctrinaire approach to national leadership. Each to a large extent was an opportunist. Each proved to be a master at the art of evolving policy gradually. Each strove for and achieved political compromises around which generally moderate majorities rallied. All three, as well as Borden in 1917, saw in the preservation of national unity their chief goal. All three successfully generated and guided forward momentum in the Canadian political process.

The bulk of this study is a complex narrative of personalities and events in Canadian government which is believed to be of intrinsic interest. In addition, the whole record is intended to demonstrate the rewards of democratic leadership when it is conceived in terms of pragmatic opportunism. The latter is defined as basing policy on a combination of pressures emanating from the people. The narrative as a whole is further intended to demonstrate the penalties attached to ignoring pressures emanating from the people, or to attempts to make them conform to an arbitrary or rigid pattern. The ultimate conclusion which the dissertation strives to prove and illustrate is that the primary responsibility for the leadership a democratic society enjoys politically rests directly with that society; that political leadership in a democratic society is a limited function, in theory and practice, dependent on social factors beyond its control; and that for the development and protection of its basic values a democratic society must look less to its political leaders than to its philosophers, educators, artists, and citizens in general.

737 pages. $9.35.

THE GREEK CONSTITUTION OF JANUARY 1, 1952

(L. C. Card No. Mic 58-1860)

Stelios Stavros Papadakis, Ph.D.
University of Pennsylvania, 1958

Supervisor: Dr. Bradford W. West

The purpose of this study is to fill a gap in the bibliography on Comparative Government. There is practically no bibliography, in any other language except Greek, on the political history and current constitutional setup of Modern Greece. The problem, as stated from the start, was to analyze, synthesize and arrive at a philosophical and sociological evaluation of the new Greek Constitution. Most of the principles of the new Greek Constitution have their origin in the Golden Age of the ancient Athenian Democracy. The democratic concepts were amplified by Western political theory and practice. After the liberation of Greece, some 130 years ago, these concepts, in their original or amplified form, were again rooted on the Greek soil and have followed an evolutionary process all of their own, within the general framework of the spiritual, institutional, political and social evolution of the Western World.

The purpose of this study has, therefore, been to trace the threads that link the present constitutional setup with the past.

The origin and evolution of all the basic concepts of the Greek constitution have been traced historically. Simultaneously, the comparative method has been used. The present-day Greek political institutions are linked with the past and compared and contrasted with the political institutions of other countries.

The nature of this study was such that it was not possible to lead to any sensational "discoveries". The basic concepts of the new Greek Constitution, were analyzed, synthesized and evaluated.

Against the historical, social and political background of the new Greek Constitution (Introduction), a substantive examination was undertaken of the various constitutional provisions, grouped together in "functional" units.

The new Greek Constitution is a progressive and, at the same time, conservative document, in the true sense of these terms: conservative, because it preserves whatever is valuable from the heritage of the past; progressive, because it gives new meaning to the ideal of the good and free society, dreamt by the idealists of the past, in ancient Athens and the modern western world.

The new Greek Constitution is based on the fundamental concepts of political democracy; in this respect it is "conservative", for it conserves a priceless heritage. But it is also "progressive", for it approaches private property as a "functional" problem. In this approach, it could very well serve as a prototype to other constitutional texts.

The period of time that elapsed since January 1, 1952 (when it was put in effect), although brief, has shown that the new Constitution, if not "ideal" as a document, is, nevertheless, most adequate as a framework for a democratic government with such a tradition (despite temporary ebbs) as that of Greece. 333 pages. $4.30.

CONVENTIONS OF THE COUNCIL OF EUROPE WITH SPECIAL REFERENCE TO THE CONCEPTS OF NATIONALITY AND STATUS: A DOCUMENTARY HISTORY

(L. C. Card No. Mic 58-1873)

Barbara Jean Larson Shockley, Ph.D.
University of Pennsylvania, 1958

In 1949, two Italian Proposals hesitantly looked toward the day when there might be created a "European nationality" or a "European citizenship" in a new "European order".

Aside from the Statute, which brought the Council of Europe into being in 1949, the Member States were making little progress toward its aim, namely, "to achieve a greater unity between its Members" -- or so it seemed for six years. Then, on September 3, 1953, the European Convention for the Protection of Human Rights and Fundamental Freedoms entered into force. Since 1953, the Member States of the Council of Europe have concluded fourteen Conventions and Agreements and have deposited one hundred thirty-two instruments of ratification with the Secretary-General of the Council of Europe.

These statistics support the conclusions of the thesis presented in this Study: there has been, since 1949, a gradual and voluntary breaking down of the national barriers which for so long have retarded the free circulation of persons.

The machinery and procedural channels of the Council of Europe have been instrumental in bringing the European States closer together. The Committee of Ministers has turned the inhibiting principle of unanimity into a measure of solidarity. Through international conferences and committees and other means of diplomatic negotiation, a number of European problems have been brought to the signature stage of a Convention or Agreement. The Consultative Assembly, uninhibited by a principle of unanimity, has been the disseminator of ideas and projects in the form of Recommendations and Resolutions. At home, in their own parliamentary bodies, the Representatives (most of whom are parliamentarians) are in a position to encourage or discourage ratification of the Conventions and Agreements by their respective Governments.

Five of the Conventions and Agreements have an important bearing on nationality and status, for they are concerned with the equalization of the legal status of the nationals of the Member States:

(1) The European Convention for the Protection of Human Rights and Fundamental Freedoms aspires to lay down and enforce a norm of human rights and fundamental freedoms. To claim such rights the nationality of the "person" must not be in doubt.

(2) The two European Interim Agreements on Social Security and the European Convention on Social and Medical Assistance represent a first step in the direction of establishing equality of treatment for the nationals of all Member States in regard to social security or in regard to social and medical assistance.

(3) The European Convention on Establishment aims to place the nationals of each Member State on the same footing as the nationals of all the other Member States in regard to the enjoyment and exercise of their private rights and full legal and judicial protection of their person, property, rights, and interests.

From these Conventions and Agreements emerges a pattern which, although shadowy in parts, traces the development of a new concept: the European nationality.

The Council of Europe has pointed the most promising route to the creation of a European order in which ancient sovereignties will yield their claims upon the individual to a larger and, possibly a federal, community.

If the approaches which the work of the Council of Europe has initiated can be taken as the projection of future developments, then it is likely that, within the lifetime of this generation, European nationality will receive its appropriate judicial sanction. 419 pages. $5.35.

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

THE INTERNATIONAL LEGAL STATUS OF AUSTRIA, 1938-1955

(L. C. Card No. Mic 58-625)

Robert Eugene Clute, Ph.D.
Duke University, 1958

Supervisor: Robert R. Wilson

The Anschluss and the Allied occupation of Austria gave rise to some doubt as to Austria's international legal status. The predominant opinion in Germany is that Austria was legally annexed and the Austrian State extinguished. However, the Austrian Government and the vast majority of the Austrian writers claim that the Anschluss was an illegal act of force which did not result in a valid title. According to the latter group, the Austrian State was not extinguished, but was merely prevented from functioning during the de facto domination by Germany with the result that the state powers remained dormant and re-emerged intact after Austria's liberation. Writers have also questioned the fact that Austria was a state during the period of Allied occupation.

This work examines the practice of the international community in regard to Austria. Evidence is obtained from state documents, records of international organizations and decisions handed down by national and international courts. Austrian and German treatises on the effects of the Anschluss are also discussed. These materials are evaluated within the framework of the international law of recognition and state succession.

Documentary evidences reveal that the Anschluss was an illegal act in violation of Germany's treaty obligations. The contractual agreements resulting from the movement for the outlawry of illegal acquisitions of territory, as embodied in such instruments as the Covenant of the League and the Pact of Paris, created an almost universal obligation on the part of the international community not to recognize such an illegal act. Germany's attempt to gain a legal title was greatly hampered by the delaying mechanisms developed through state practice to prevent

illegal acquisitions of territory from attaining legal consequences. The difference between de facto and de jure recognition was sharpened. Implied recognition became greatly restricted so that nothing short of an explicit recognition of such a situation could be considered tantamount to de jure recognition. Although there was a tendency to grant de facto recognition of the Anschluss prior to the outbreak of World War II the act did not receive widespread de jure recognition. Consequently, Germany did not gain a legal title to Austrian territory.

The announced purpose of the Allied occupation of Austria was the liberation of the country to re-establish an independent Austria. The occupants refused to recognize the validity of the Anschluss and made no claims to Austrian territory. Initially the powers assumed by the occupants prevented Austria from exercising her full powers and her status was therefore similar to that of a protected state. However, after the signing of the second Allied Control Agreement of June 28, 1946, Austria re-emerged as a full state. This was possible because the 1946 Agreement subjected most actions of the occupants concerning Austria as a whole to the unanimous approval of the Allied Council. Since it was almost impossible to attain unanimity the net result was that Austria attained the freedom of action necessary to regain her status as a state.

Strong confirmation of the continuity of the Austrian State is also to be found in an examination of state practices. The matter of Austrian nationality shows some departures from the idea of continuity, but nevertheless supports continuity. Post-Anschluss Austria assumed the pre-Anschluss public debt; pre-Anschluss Austrian treaties are in effect in regard to present day Austria; and the actions of international organizations support the continuity of the Austrian State. It is therefore submitted that the present Austria and pre-Anschluss Austria are one and the same state. 306 pages. $3.95.

THE UNITED NATIONS COMMISSIONS IN KOREA, 1947-1950

(L. C. Card No. Mic 58-2235)

Leon Gordenker, Ph.D.
Columbia University, 1958

The United Nations, attempting as a result of American initiative to secure unification of Korea under an independent government for two and one-half years preceding the aggression of 1950, kept in the field subsidiary organs of the General Assembly. These were to observe elections and other political occurrences, assist in unification and consult on establishing and maintaining representative government in the strategic peninsula. The first of these organs, the Temporary Commission on Korea, lost its considerable influence on the withdrawing American military occupation after it had observed the 1948 elections in the southern zone. Divided as to its policy, it undertook observations on the advice of the Interim Committee of the General Assembly. From the election grew the Republic of Korea, but the Temporary Commission and the succeeding Commission on Korea now exerted only slight influence. Neither of the Commissions succeeded in observing elections or even entering the northern zone in the face of unrelenting Soviet and North Korean opposition.

In addition to feeling the burden of Soviet-American division over broad policy for Korea, the Commissions found relations with the Republic of Korea difficult, especially on questions of the development of representative government, considered by the Republic as a matter of reserved domestic jurisdiction. The Commissions, moreover, were backed by inadequate political support and instructions on this and other questions, for the General Assembly disposed of their reports without full discussion and issued new directives without making perfectly clear the aims and methods of the field bodies. Nevertheless, the Commissions managed to observe and influence the 1948 elections; warn in 1949 of the general possibility of violence; draw closer to the Republic early in 1950, again observing an election; and secure preparation by its rudimentary military observation system of a report on the military situation along the thirty-eighth parallel immediately before the North Korean attack.

A study of the operations of the Commissions shows, however, that they acted neither with the highest efficiency nor on the basis of fully rational examination of broad factual knowledge. Instead, local pressures, vague directives, conflicting instructions to representatives of states making up the Commissions and the troubled international atmosphere all had a bearing on the decisions and programs developed by the General Assembly subsidiaries in Korea. As a result, their successes often appear as much accidental as deliberate, the products of weakness as often as of strength.

The cumbersomeness and internal friction of the Commissions suggests that their form of organization might not have been appropriate for work in Korea, where expert interpretation, independent judgment and quick reporting were required both for useful decisions by the General Assembly and for maximum effect in the immediate environment. A single representative, it is concluded, probably would have performed with greater efficiency and with political effect more closely linked to the ultimate aims of the United Nations in Korea. Especially, he might have given clearer warnings and sounder information on the possibility of aggression. 435 pages. $5.55.

THE IDEAS AND OPERATIONS OF THE CULTURAL ACTIVITIES PROGRAMME OF UNESCO (1945-1952) IN THE CONTEXT OF THE UNESCO PROGRAMME AS A WHOLE

(L. C. Card No. Mic 58-2238)

Melvin Erwin Levison, Ph.D.
Columbia University, 1958

Unesco--The United Nations Educational, Scientific, and Cultural Organization--founded in 1945 on the belief that education, science, and culture were as important as politics and economics to establish and maintain peace, was dependent on its Member States and on previous international nongovernmental organizations for its ideas, policies, and personnel. The Organization, from its beginning, faced the difficulties of other United Nations Agencies, plus that of developing a programme suitable to

its unique role. From 1946 through 1952, Unesco, under two Directors-General with different outlooks, was hemmed in by limited budgets and harrassed from all sides as it strove to develop a series of programmes reflecting its ideals.

The Cultural Activities Programme of Unesco (CAP) was one of the five major areas of the Unesco Programme. Subdivided into programmes for Arts and Letters, Philosophy and Humanistic Studies, Libraries and Museums and responsible for almost half the Unesco projects, the CAP was laboring toward an ecumenic but practicable programme during the seven years covered by this study. Not until late 1947 did it launch its first uncorrelated activities. As its activities expanded, the CAP, except for certain Libraries and Museums projects, was never given prominence in the Unesco Programme as a whole, but was gently sidelined by the emphasis, under Julian Huxley, on the Natural Sciences, and under Torres Bodet, on Fundamental Education and Technical Assistance.

Despite such hardships, the CAP made some notable achievements. Stimulating and coordinating activities in such diverse areas as translations, audio and visual reproductions, the theater, the arts in general education, the Arts and Letters Programme could boast of the establishment of the International Theater Institute and the International Music Council to which Unesco proffered subsistence in return for counsel and help in programme activities; the convening of the Arts Conference at Bristol in 1951, which validated new approaches to art education; the convoking of the International Arts Congress at Venice in 1952, the first of its kind to win artists' support; and the adoption of a Universal Copyright Convention in 1952 by an international congress.

Frailest of the CAP subdivisions, the Philosophy and Humanistic Studies Programme, nevertheless, could point to the establishment of the International Council for Philosophy and Humanistic Studies, the "umbrella organization," which, with Unesco's assistance, stimulated and sponsored such activities as the convening of philosophic discussions, the analyses of fundamental philosophic concepts, the comparative study of cultures, the launching--despite initial opposition--of a Scientific and Cultural History of Mankind, and the convening of an East-West Conference at New Delhi in 1951 which treated "The Concept of Man and the Philosophy of Education in East and West."

The Libraries and Museums Programmes, because of their practicality and concreteness, unlike the other two CAP subdivisions, operated with some success from the very beginning of Unesco's existence, contributing to the CAP and other areas of the Unesco Programme. Certain of their projects continued unaffected or were even furthered by the later emphasis on Technical Assistance and Fundamental Education. Though major plans for the standardization of bibliographical and documentary data were abandoned for lack of money, a scheme to increase the flow of books, scientific equipment and films, was eminently successful; so were the public library seminars, which spread the latest techniques, and public library pilot projects, which were reaching new literates, thereby increasing, in underdeveloped countries, the availability of scientific knowledge. 488 pages. $6.20.

POLITICAL SCIENCE, PUBLIC ADMINISTRATION

CIVILIAN CAREER PLANNING IN THE DEPARTMENT OF DEFENSE

(L. C. Card No. Mic 58-2410)

William Charles Valdes, Ph.D.
The American University, 1958

The dissertation examines the need for comprehensive civilian career planning by the Department of Defense, the nation's largest employer, to attract, retain and develop the myriad civilian talents required in the Department. The current status of civilian career planning in the Department and the manner in which the fundamentals of military career planning and industrial executive development programs can be adopted with advantage to such career planning are explored.

Included in the study are an analysis of the composition and purpose of the huge civilian work force of over a million persons in the Department of Defense; the factors in an expanding economy which make it difficult for the Department to compete with private industry for scientific, technical, professional and administrative talent; the internal circumstances which reflect the need for better career programs; and the concepts on which improved career programs should be based, with particular reference to the lessons to be learned from the military career system.

Basic concepts in military career planning and in comprehensive industrial executive development programs are outlined which could be applied with good advantage to the problems of civilian career planning in the Department of Defense. Current trends in the civilian career planning policies of the Secretary of Defense and the military departments are analyzed. The status and problems of civilian career planning, in four major organizational units employing about 250,000 civilian personnel, are examined in detail. The military-civilian distribution of management positions in the support activities, based on a sample of 24,000 positions, is analyzed. Traditional personnel management concepts which impede comprehensive civilian career planning are identified and a course of corrective action proposed.

Results of the study indicate a need to shift from concentration on individual installation personnel management to broader and more comprehensive career planning on a command and department-wide basis. A principal means for accomplishing this objective is found to be the development of career programs for major occupational groups that will provide for long range planning to meet continuing personnel needs, regular intake at the bottom of carefully screened personnel, careful appraisal of personnel to determine training needs and potential for advancement, systematic development of employees using a wide range of development techniques, and referral and placement of employees on a broad organizational basis within each occupational field.

It is also concluded that more of the key positions in the predominately civilian support activities must be opened to civilians if the Department is to offer attractive civilian career opportunities and a clearer delineation must be made of the roles of military and civilian personnel. The study finds that this objective cannot be

obtained through the issuance of general criteria but can be accomplished only through an aggressive program of top management staffing control, supported by manpower and appropriation controls.

The methods used in the study included: (1) Interviews with key military and civilian personnel in the Department of Defense concerned with personnel management and with representatives of a number of industrial corporations with comprehensive programs of executive development; (2) study of official reports, records, and regulations of the Department of Defense; (3) study of books and periodicals containing relevant information on management development; and (4) personal observation during years of personnel management experience in the Department of Defense and private industry. 333 pages. $4.30.

PSYCHOLOGY

PSYCHOLOGY, GENERAL

ATTITUDES IN CHILD REARING PRACTICES OF WHITE ADOPTIVE PARENTS BEFORE AND AFTER PLACEMENT OF A CHILD IN THE HOME

(L. C. Card No. Mic 58-1582)

George E. Ackley, Jr., Ph.D.
The Florida State University, 1958

The purpose of this dissertation was to study the effect upon attitudes of white adoptive parents in respect to child rearing practices as a result of receiving a child in their home for adoption. Measures of these attitudes of 69 marital pairs who received children for adoption were obtained by the use of the University of Southern California Parent Attitude Survey developed by Shoben. Measures were secured just prior to the placement of a child in the home for adoption and again three months following placement. All placements were made by the Tennessee Department of Public Welfare and were from both rural and urban areas. A control group of 23 prospective white adoptive parents matched proportionately to the experimental group as to age and socio-economic status was used.

Parents' attitudes were studied according to their socio-economic status which was determined by employing the McGuire-White Index of Social Status. Three levels were designated--upper, middle, and lower.

The evidence indicates that children placed for adoption in the State of Tennessee by the Tennessee Department of Public Welfare do not effect significant changes in parental attitudes toward child rearing within a three month interval following placement as measured by the Shoben Survey, and as determined by the analysis of variance technique. This was found to be true on the total score, and three subscale scores--dominant, possessive, and ignoring. Husbands' attitudes were comparable to their wives' attitudes with the experimental groups not significantly different from the controls. The mean scores for all groups were favorable to Shoben's "non-problem" mothers.

Many factors were suggested by this study for further investigation. Would greater time intervals following placement tend to reveal a change in attitudes toward child rearing? Would attitudes change following the final adoption proceedings? Would varying ages of children contribute to greater or lesser changes in attitudes of parents toward child rearing following placement for adoption? Do attitudes toward child rearing of approved prospective adoptive parents compare favorably to those who are disapproved for child placement? Do attitudes toward child rearing of adoptive parents compare favorably to the same attitudes of parents of the general population?

50 pages. $2.00.

THE EFFECTIVENESS OF TWO GROUP VOCATIONAL GUIDANCE TREATMENTS

(L. C. Card No. Mic 58-2204)

Kathryn Rooney Biersdorf, Ph.D.
University of Maryland, 1958

Supervisor: Dr. Thomas M. Magoon

The purposes of this study were: (a) to ascertain whether a limited and an extended group vocational guidance treatment were more effective than no group vocational guidance, and (b) to determine if the extended group vocational guidance treatment was more effective than the limited group vocational guidance treatment.

The subjects of this study were 71 male students interested in receiving assistance with their vocational plans, who were recruited from introductory psychology and speech classes at the University of Maryland.

Subjects were randomly assigned within the limits of their free class hours to three groups: a limited treatment group, an extended treatment group and a control group. Each of the two treatment groups was subdivided into three groups of eight members. Each smaller group of eight was the unit receiving treatment at one time. Three graduate student counselors conducted the treatment programs, each responsible for one limited and one extended treatment group. The limited treatment program consisted essentially of a group interpretation of vocationally relevant tests taken by the subjects. The extended treatment program included, in addition to group interpretation of tests, group discussion of the numerous factors relevant to making adequate vocational plans.

The variables used to assess the effectiveness of the group vocational guidance treatments were: (a) change in certainty about vocational choice, (b) change in appropriateness of vocational choice, (c) change in suitability of certainty in terms of appropriateness of vocational

choice, (d) change in degree of concern about vocational problems, and (e) change in degree of concern about non-vocational problems.

The Vocational Choice Inventory, the Mooney Problem Check List, the Strong Vocational Interest Blank, the Personal History Data Sheet, and the Maryland Freshmen Test Battery were utilized for deriving the above criteria. Appropriateness of vocational choice was determined by clinical judgment of three counselors.

Only one significant difference was found in assessing the relative effectiveness of the experimental and control groups. Individuals who received extended treatment, as compared to the controls, were found to evidence a significantly greater reduction in number of vocational problems about which they had considerable concern (one of the three indices derived from the Mooney Problem Check List). This was significant at the .05 level. Although the results were generally negative in terms of statistically significant support of the hypotheses, most of the obtained differences between the groups were in the predicted direction. It was concluded, that in general the limited and extended group vocational guidance treatments were not more effective than no treatment and the extended treatment was not more effective than limited treatment. The fact that the mean trends for four out of the five criteria were in the predicted direction however, would support the possibility that there may have been a real, but very slight difference between the effectiveness of extended treatment, limited treatment and no treatment, which was in the predicted direction.

It is not concluded that group vocational guidance per se is ineffective. However the position is taken that the effectiveness of group methods for dealing with vocational problems has been overestimated by previous studies as a result of their frequent utilization of inadequate criteria and methodology.

Suggestions are offered as to why the treatments utilized in the present study were ineffective; and suggestions for improvement of group treatment programs on the basis of the present study are presented.

152 pages. $2.00.

SELF CONCEPT, IDEAL SELF CONCEPT, AND ACHIEVEMENT

(L. C. Card No. Mic 58-2459)

Arthur Wright Chickering, Ph.D.
Columbia University, 1958

Academic achievement and two aspects of the self, the actual self concept and the ideal self concept, were the major focus of this study. The variation of achievement in relation to the discrepancy between the actual and ideal self concept was examined: the relationship between self-discrepancy and emotional withdrawal was also investigated. In addition it was possible to study qualitative differences in actual self concept and in ideal self concept in relation to different levels of achievement.

It was hypothesized that as the discrepancy between actual self-perceptions and ideal self-perception increased, academic achievement and effort in school would decrease and withdrawal from the school situation would increase. It was also hypothesized that underachievers and overachievers differed in actual self concepts and in ideal self concepts.

Two groups of subjects, 59 in the first group and 48 in the second group, were selected from two consecutive ninth grade classes in a public high school on Long Island, New York. An appropriate Q sort was constructed and administered twice to each subject. On the first administration subjects were asked to sort the items to describe themselves "as you really are right now." On the second sort subjects were asked to describe themselves "as you would most like to be." A measure of the discrepancy between the actual self-perceptions and the ideal self-perceptions was obtained for each subject by correlating his actual self-sort with his ideal self-sort. This correlation coefficient was called the "discrepancy score."

Using group achievement and group intelligence test scores, and age academic achievement was measured while intelligence and age were controlled. Major subject teachers rated one group of subjects on five point scales related to effort in school, and for another group of subjects the total number of absences during the school year were recorded.

The following results were obtained:

1. There is an inverse relationship between academic achievement and the discrepancy between the actual and ideal self concept.
2. Underachievers apply certain actual self-perceptions to themselves to a greater degree than do overachievers.
3. Overachievers apply certain actual self-perceptions to themselves to a greater degree than do underachievers.

Additional findings suggested that:

1. The ideal self-perceptions of underachievers and overachievers are more similar than are their actual self-perceptions.
2. Underachievers apply to themselves items seen as <u>least</u> self-descriptive by the general population, to a greater degree than do overachievers, while overachievers apply to themselves items seen as <u>most</u> self-descriptive by the general population, to a greater degree than do underachievers.

There was no evidence which indicated a stable relationship between self-discrepancy and effort in school or school absence. Neither was there evidence that underachievers differ from overachievers in ideal self-perceptions. The results instead suggested that the relationship between academic achievement and the discrepancy between the actual and ideal self concepts, pertain primarily to differences in the actual self concept.

81 pages. $2.00.

THE RELATION OF INDEPENDENCE OF WORK EXPERIENCE TO GENERAL ADOLESCENT INDEPENDENCE AND CERTAIN INDICES OF VOCATIONAL MATURITY

(L. C. Card No. Mic 58-2234)

David Cohen, Ph.D.
Columbia University, 1958

Various theories of vocational choice and development have been presented in the literature of developmental

psychology, sociology, and economics. The Career Pattern Study of the Horace-Mann Lincoln Institute of School Experimentation is presently conducting a longitudinal study of the vocational development of eighth and ninth grade boys. Its purpose is to gain further insight into the dynamics of vocational choice and adjustment.

In order to provide a basis for measuring vocational development, the Career Pattern Study has suggested the concept of vocational maturity which has become a critical variable in the Study. Vocational maturity is a qualitative measure of the behavior of the individual in handling the developmental tasks with which he is coping at any given time. It is considered to be one phase of the overall concept of general maturity with its own specific as well as general maturity characteristics.

A review of the literature of adolescent psychology emphasizes the significant part played by independence in achieving the goal of general maturity. It was therefore hypothesized that independence is also important for the development of vocational maturity and that, in this context, it could be differentiated from the more general adolescent independence. This led to the concept of vocational independence, defined for this study as the ability of the individual to make vocational plans and decisions and to engage in vocational activities free from immediate parental supervision.

It was hypothesized that vocational independence as defined above would be positively related to general adolescent independence in ninth grade boys and to such elements in vocational maturity as intellectual level, interest maturity, the existence of well-defined interest patterns on the Strong Vocational Interest Blank, agreement of expressed vocational preferences with primary or secondary interest patterns on the Strong, and the vertical occupational mobility of the family. Negative relationships were hypothesized with the family's socioeconomic status and the number of educational and vocational problems indicated by the boys.

A scale was developed for the measurement of vocational independence through analyzing the protocols of the interviews conducted with 130 boys in a study in the areas of out of school activities, school activities, the family, and plans for the future. Internal consistency analysis of the obtained scores resulted in reducing the scale from seven to five components related to the independence of work experience. This new scale was shown to be a reliable, internally consistent measure of independence of work experience, composed of related but independent components.

Vocational independence, as used in this study, was found to be unrelated to general adolescent independence, intellectual level, interest maturity, socioeconomic status, vertical occupational mobility, number of educational and vocational problems, and the extent of integration of expressed vocational preferences and measured interests. On the other hand, a significantly positive but low relationship was found between vocational independence and the degree of crystallization of vocational interests.

Limitations inherent in the present concept of vocational independence, in the instrument used for its measurement, and in the types of work experiences commonly available to ninth graders were discussed as significant factors in the rejection of seven of the hypotheses. It was suggested that the corroboration of the one interest hypothesis was basically due to the fact that, during the early adolescent period, a measure of interest patterning may be a more appropriate index of vocational maturity than the others used.

The results of this study indicate the need for further research with the concept of vocational independence as a phase of vocational maturity. Suggestions for such research were offered in terms of the concept and scale used in this study as well as with other concepts and measures of vocational independence. 91 pages. $2.00.

A STUDY OF APPRAISAL METHODOLOGY: THE EFFECT OF THE COORDINATOR IN APPRAISAL

(L. C. Card No. Mic 58-2325)

Norman Frisbey, Ph.D.
Michigan State University, 1958

Sixty-four first line supervisors, in an industrial plant, each rated or appraised the job performance of three subordinates. Two methods of administration, two coordinators, and two locations were incorporated into a factorial design. Method of administration, which involved comparing coordinated with non-coordinated appraisals, was the variable of primary interest. The coordinator was a personnel staff person who conducted the appraisals by questioning the appraiser and recording the responses in a modified Field Review type interview.

The objectives of appraisal were: (1) evaluation of present performance, and (2) planning for individual improvement. It was predicted that the coordinated appraisals would be superior to the non-coordinated in meeting these aims.

The relative merits of the methods as a system of evaluation were inferred by comparing the treatment groups on secondary criteria of a rating method. It was predicted that the ratings of the coordinated appraisals would be improved by increased discrimination, reduced leniency, reduced halo, increased coverage, and increased comparability between ratings. The findings did not support the above predictions. No significant differences were found between the methods, coordinators or locations on these factors. It was concluded that the coordinator did not improve the effectiveness of the appraisal as a rating instrument.

Immediate criteria used to evaluate the appraisal as a development instrument were established from an examination of its function in the development procedure. Subsequent to the appraisal session the information recorded on the form was to be used for (1) a review by the appraiser's supervisor, (2) a performance interview with the employee, (3) training and development of the subordinate, and (4) follow-up on action by the coordinator. The areas of the form important to the above steps were the supporting facts and performance summary which contained sections for a summary of individual performance strengths, development needs and development plans.

It was predicted that the coordinated appraisals would be superior to the non-coordinated in terms of the quantity and quality of responses recorded in these sections. The findings did support these predictions. The supporting facts of the coordinated appraisals contained a greater amount of information and were more descriptive of specific performance than those of the non-coordinated group.

The non-coordinated group of appraisals contained a greater number of appraisals with Sections 1, 2, and 3 of the performance summary omitted. The performance summaries of the coordinated appraisals contained a larger number of performance strengths, development needs, and methods of handling development needs. The development needs for the coordinated group were more frequently related to the supporting facts. The coordinated appraisals more frequently placed responsibility for development action on the supervisor and more frequently mentioned on-the-job coaching as a method of development than the non-coordinated appraisals.

It was concluded that the coordinator did effect an improvement on the appraisals as an instrument for development in terms of the procedure outlined and the criteria used for evaluation. In fact, it can be said that the coordinator plays an essential role and makes a significant contribution to the development procedure.

148 pages. $2.00.

INTENSITY, INVOLVEMENT AND PERCEPTUAL STRUCTURE AS RELATED TO COMMUNITY ATTITUDES

(L. C. Card No. Mic 58-2281)

Lane Hesser Riland, Ph.D.
The Pennsylvania State University, 1958

Three problems were investigated in this study of the attitudes of the members of a community toward a local company. The first involved the testing of the Guttman-Foa hypothesis that social contact is unrelated to the strictly dichotomous positiveness or negativeness of the attitude, determined by the zero point of the intensity curve, but is related to the intensity of that attitude. In the second problem, it was hypothesized that the curve of involution would closely approximate the curve of intensity, showing that the most involved respondents would be the most and least favorable. It was also hypothesized that there would be a substantial correlation between intensity and involution scores. Another hypothesis was that the members of the community most and least favorable toward the company in general would also be the most and least favorable toward other component attitude areas such as the community contributions and the employee relations policies of the company.

Three Guttman unidimensional scales were developed covering general attitude toward the company, attitude toward its community contributions, and its employee relations policies from a probability sample of 388 members of the community.

In studying the relationship of social contact and intensity, three indices of contact were employed: number of company employees known, years of residence in the community and whether or not the respondent knew of any actual management changes in the company within the past five years. These were individually related to four measures of intensity: degrees of favorableness of general content scale item responses, frequency of extreme responses (most favorable-least favorable and most favorable-don't know) to all questionnaire items scalable or not, and the two-part Guttman intensity scores.

Involution was measured by three items, and the resultant curve obtained by plotting the involution scores against general content scores was compared to the intensity curve obtained by plotting intensity scores against general content scores. The scores of intensity and involution were also statistically correlated.

In analyzing the perceptual structure of the community's attitude toward the company, the content scores from each of the three unidimensional scales were intercorrelated.

The following conclusions appear to be justified within the limitations of this study:

1. The amount of contact with the company is unrelated to the direction, i.e., strictly dichotomous favorableness or unfavorableness, of the general attitude toward the company expressed by the members of the community, but is related to the degree of favorableness or unfavorableness.
2. The amount of contact with the company shows a low, but significant positive relationship with the intensity of the general attitude toward the company as expressed by the members of the community.
3. Those respondents most involved in their attitude toward the company in general are on the average most favorable and most unfavorable in general attitude content.
4. There is a moderate, but substantial, significant positive relationship between the intensity of the general attitude toward the company and personal involvement in the affairs of the company.
5. The attitude of the members of the community toward the company appears to be a fairly well-structured perceptual whole in that there is a high to moderate significant interrelationship between the general attitude toward the company, and attitudes toward unidimensional component areas such as the community contributions of the company and its employee relations policies.

118 pages. $2.00.

THE SELF CONCEPT: ITS RELATIONSHIP TO PARENTAL AND PEER ACCEPTANCE

(L. C. Card No. Mic 58-2331)

Albert Wolf Silver, Ph.D.
Michigan State University, 1958

Fifty-six male adolescents in the seventh through twelfth grades of a rural school completed seven self concept rating scales from their own viewpoint and the points of view of parents and peers, a measure of defensiveness, and sociometric acceptance - rejection scales. To obtain measures of parental acceptance forty-one mothers and twenty-five fathers cooperated in rating the subjects from two points of view on scales identical to the self concept ratings. Pearson product-moment correlation coefficients were computed to test a number of hypotheses operationally expressed in terms of correlations between measures derived from the parent ratings, self concept ratings, and sociometric scales.

The results indicate that the level and stability of self concept ratings is significantly associated with paternal acceptance and to a lesser degree with maternal acceptance. Level and stability of self concept ratings is also

significantly associated with perceived measures of peer acceptance but not with actual measures of peer acceptance or with accuracy of social perception. Actual peer acceptance also correlates with measures of maternal acceptance while paternal acceptance is associated with measures of expected poor acceptance and accuracy of social perception. Level and Stability of self concept ratings is consistently and significantly associated with accuracy in perceiving the self as parents and peers perceive it. Finally, high and stable self concept ratings are positively associated with congruence between a subject's private self concept and the concepts which he believes parents and peers have of him.

While defensiveness, as it is measured in this study, was not found to correlate significantly with any self concept rating measures, age, and to a lesser degree, intelligence, correlated with measures of self concept level, parental acceptance, peer acceptance, and measures of ability to perceive the self from parents' and peers' points of view. However, nullifying the effects of age and intelligence on predicted correlations by partial correlations left the experimental findings essentially unchanged. Measures of self concept level and stability were compared and a tentative conclusion was reached that test-retest reliability is a measure of intrapsychic stability while the level of self concept ratings is a measure of interpersonal adequacy although both are statistically and psychologically related concepts.

Suggestions for further research dealing with hereditary factors contributing to self concept adequacy, study of the relationship between patterns of familial relationships and later patterns of social interactions, study of personality differences between the sexes in terms of single and multiple identifications, and criticisms of the study, were presented in the final section of the study. 146 pages. $2.00.

YOUTH'S PROBLEMS AS THEY SEE THEM: A STATISTICAL ANALYSIS AND RESTANDARDIZATION OF THE SRA YOUTH INVENTORY

(L. C. Card No. Mic 58-1816)

Lawrence Edwin Taliana, Ph.D.
Purdue University, 1958

Major Professor: Hermann H. Remmers

The purpose of this study was to improve and restandardize an instrument that has been used extensively to measure problems and needs of high school students and to analyze the socio-psychological data obtained. In 1948, the S R A Youth Inventory was constructed and standardized on a stratified, nationally representative sample of 2500 high school students. This instrument has been effectively used in differentiating students who are achievers and non-achievers. It has also differentiated between "poorly-adjusted" and "well-adjusted" students based on high school counselor's ratings.

The original instrument contained 298 items grouped in eight problem areas relating to problems about school, self, future, getting along with others, boy-girl relationships, health, home and family, and things in general. These eight categories were retained in the revised instrument. Scattered throughout the original Inventory 101 items comprising a basic difficulty key were selected by judgmental ratings as indicative of rather severe maladaptive behavior. Instead of the dichotomous response of the original the revised instrument used a graphic intensity dimension weighted 3, 2, 1, and 0.

Since a number of years had elapsed since the instrument was constructed, it was deemed desirable to check if there was need for new items or elimination of old items. Anonymous letters and essays from students across the nation revealed their problems. From these a large pool of items was obtained as the students stated them in their own language. This pool was compared with the items in the original instrument. Twenty-two new items mentioned frequently in the letters and essays were added and twenty-four old, infrequently mentioned items were eliminated. Twenty-seven of the original items were reworded slightly.

This Inventory was administered to over 12,000 high school students across the nation in the spring of 1956. Of this group, a stratified random sample of 3000 was obtained for standardization and analysis purposes. Norms were computed for each of the eight areas, the total, and the Basic Difficulty area. Norms were computed by grade and sex.

The coefficients of internal consistency were .90 and above for each of the areas. The total test revealed an internal consistency of .98.

Each of the separate areas of the Inventory was correlated with every other area.

A series of hypotheses was tested related to the intensity of student's problems as they related to such variables as sex, grade, religion, region, socio-economic status, religious attendance, mother's education, and residence. It was concluded that environmental variables have significant effect upon the frequency and intensity of problems experienced by students in the public high school population. 150 pages. $2.00.

PSYCHOLOGY, CLINICAL

A COMPARATIVE STUDY OF THE DOMINANT PERSONALITY TENDENCIES, AS SHOWN BY THE CALIFORNIA TEST OF PERSONALITY, OF SELECTED CEREBRAL PALSIED AND SELECTED PHYSICALLY NORMAL CHILDREN

(Publication No. 20,270)

Dorothy Frances Abrams, Ph.D.
New York University, 1956

In this study twenty-eight cerebral palsied children with minimum speech, hearing or vision impairment, attending public special schools for the handicapped, between the ages of 9-12, and with I.Q.'s ranging from 80-120, were matched with physically normal, public school children for age, sex, and I.Q., and both groups were administered the California Personality Test. The dominant personality tendencies for both groups, as indicated by the test results,

were, "Self-Reliance," "Sense of Personal Worth," "Feeling of Belonging," "Freedom from Withdrawing Tendencies," "Freedom from Anti-Social Tendencies," and "Family Relations." The only significant difference in tendencies between the two groups, fell in the categories of "Freedom from Withdrawing Tendencies" and "Family Relations." The cerebral palsied group showed better adjustment than the normal group in all categories.

Although the normal group had more children with serious deviations than did the cerebral palsied group, and the deviations were more severe among the normal group, the only category where the difference in serious deviations was significant was in "Family Relations."

Both groups of children were administered Section C, "Feelings of Inadequacy," and Section D, "Physical Handicap," of the California Mental Health Analysis. The test results indicated that the normal group felt more inadequate than the cerebral palsied group. A low, but significant correlation was found to exist in the cerebral palsied group between, "Feelings of Inadequacy" and "Physical Handicap."

Personal interviews with the subjects, observation of them in single and group situations, and careful study of their case histories showed that environmental circumstances and situations, and parental attitudes were major factors in the formation of dominant personality tendencies and serious deviations.

This study indicated that if cerebral palsied children, with minimum impairment of speech, hearing and vision, were given the chance to live in average environments and allowed to attend school, socialize with their peers and participate in other such similar activities, they would be just as well, if not better, adjusted than normal children.

206 pages. $2.70. Mic 58-5053

THE RELATIONSHIP BETWEEN PRENATAL CHOICE OF INFANT FEEDING TECHNIQUE (BREAST OR BOTTLE) AND MATERNAL PERSONALITY

(L. C. Card No. Mic 58-2231)

Abby Bonime Adams, Ph.D.
Columbia University, 1958

The study was carried out in an attempt to determine the relationship between female sex-role adjustment and material personality as related to the pre-natal choice of infant feeding technique (breast or bottle). Originally it was planned to investigate post-natal ability to lactate, but the size of the successful breast feeding sample was so small as to preclude that possibility. It was hypothesized that women who chose prenatally to breast feed their infants have a more satisfactory sex role adjustment than women who chose to bottle feed.

Fifty-eight lower socio-economic class, primiparae, equated for age, race and stage of pregnancy were used as subjects. They were not volunteers.

Procedure was the same for all subjects. An initial interview was conducted. Each subject subsequently was given the Draw-A-Person Test, the Blacky Test, the Parental Attitude Research Instrument, and the Object Relations Test. All obtained data were treated quantitively wherever possible, and significance of obtained difference between bottle and breast choice groups were statistically computed. Qualitative data were judged and interpreted by two clinical psychologists and the investigator.

Thirty-five subjects chose pre-natally to breast feed their infants. Twenty-three chose pre-natally to bottle feed their infants. All members of the bottle choice group subsequently initiated bottle feeding. Of the breast choice group five were successful to a six week criterion, twenty-three were unsuccessful, and data were not obtainable from seven subjects.

On the basis of the obtained data, it appeared that the bottle choice group subjects were (1) more dependent and immature, (2) less positive in their attitudes towards the coming child, and (3) less satisfactory in sex role adjustment than the breast choice group of subjects. The pattern of psychosexual disturbance of the bottle choice group appeared to reflect these personality characteristics on a dynamic level. That is, on the basis of the Blacky Test, the bottle choice group, when compared with the breast choice group, was significantly more disturbed on orality, which is theoretically associated with dependency; on anal expulsiveness, which is theoretically associated with the rejection and destruction of foreign material within the body; and on identification mechanisms and narcissism, which are theoretically associated with inadequate assumption of the appropriate sex role.

The apparent failure of a large proportion of the breast choice subjects to breast feed successfully may possibly be a result of social and medical pressure, self-doubts accompanying unexpected feelings of ambivalence towards the child after it is born. These possibilities are only speculative, however, and remain to be validated experimentally.

Outstanding in the results of this research study is the conclusion that may be drawn on the basis of a Gestalt approach to the obtained data. It has been shown in this research that pre-natal choice of infant feeding technique is apparently related to certain personality characteristics of the mother, characteristics which will determine a host of other attitudes and actions towards the infant, child and adolescent. The option selected in feeding, breast or bottle, is but one sample of the total universe of her behavior towards the child. It is that whole complex of behavior which is a strong determinent of the child's later character, not the simple fact of whether or not the child was breast or bottle fed, or the duration of a given feeding technique.

Breast feeding may be a negative as well as a positive response; bottle feeding may be decidedly appropriate for many reasons. What is important is that the behavior of the individual is consistent with the total personality, and it is the total personality of the parents to which the child reacts, responds and incorporates in his own character. It is probably for this reason that the one-to-one correspondence so frequently sought-for between feeding experience and later behavior has led to disappointing results.

The results of this study did show so much overlapping between groups, however, that on no account may these results be legitimately generalized as pertaining to all breast or bottle choosing primiparae. 212 pages. $2.75.

PERSONAL CHANGE IN CLINICAL PASTORAL TRAINING

(L. C. Card No. Mic 58-2455)

Barbara Mae Atwood, Ph.D.
Columbia University, 1958

The present study was concerned with personal change in clinical pastoral training and the relationship between such change and certain aspects of personality and life situation. It was hypothesized that:

(a) personal change takes place to varying degrees in clinical pastoral training.

(b) personal changes which occur are related to aspects within the personality and life situation.

(c) personal change taking place during training is related to the trainee's view of himself and of his relations with others.

The subjects were 54 white male Bachelor of Divinity students enrolled in thirteen centers for their first quarter (12 weeks) with the Council for Clinical Training. Forty-one of the men had completed the first year of seminary schooling; 51 of them were between the ages of 21 and 31.

All instructions and forms for the collection of data were sent to the 16 supervisors of the 13 institutions--hospitals, prisons--participating in the study. Raw data obtained from supervisors consisted of weekly logs and check lists and a final questionnaire. Raw data obtained from the students consisted of the Cornell Index test, beginning questionnaire, weekly diary records, and final questionnaire. The trainee forms were simply handed to students by the supervisors, all forms being returned directly to the investigator for scoring and use.

The method of treating data applicable to Hypotheses I and III was similar in general procedure. Original raw data--supervisors' weekly logs and students' weekly diaries--were quantified by independent judges. Reliabilities of the judges were determined and then the ratings of degree of individual change were tested.

Hypothesis II used the same quantified supervisor logs as Hypothesis I but in a different manner. Specific variables relating to personality and life situation were examined to determine whether such variables were significantly associated with the occurrence of change.

Hypothesis I was tested by comparing the supervisors' final ratings with the "change" score obtained from the judges' quantifications of supervisors' weekly logs. Hypothesis II was tested by comparing the change score with the specific variables of maturity, pressure, and influence on vocational choice. Hypothesis III was tested by comparing the change score with the quantified student diaries.

Hypotheses I and III were confirmed, while Hypothesis II was not supported. Hypothesis I revealed that the three groups designated as "marked," "moderate," and "slight or no" change by the supervisors' final ratings were significantly different from each other with respect to the change score. Trainee diaries to test Hypothesis III were analyzed into categories of descriptive incidents, interpretive insights, and personalized feelings. The correlation between change score and diary score proved significant. High (19) and low (21) groups were formed on the basis of the change scores. The high group had significantly more expressions of feelings and higher total scores. The difference in total words for each group was not significant. Further analysis of diary categories into proportions revealed that the high group had significantly more positive feelings, while the low group had significantly more general--rather than self--insights.

Discussion of results concluded that individuals changed in varying degrees during clinical pastoral training but that no specific element of personality and life situation other than the student's view of himself and of his relations with others was significantly associated with change. In conclusion, brief discussions of trainee evaluations, implications for clinical training, and suggestions for further study were presented. 102 pages. $2.00.

CONCEPTS OF SELF AND CONCEPTS OF OTHERS IN ADJUSTED AND MALADJUSTED HOSPITAL PATIENTS

(Publication No. 22,594)

Philip Howe Chase, Ph.D.
University of Colorado, 1956

Supervisor: Professor Victor C. Raimy

The study attempted to measure psychological maladjustment. Six measures were used, all related at least superficially to Rogers' self-concept theory. These measures deal with Q-sorts reflecting a subject's concept of his present "self," his "ideal self," and his concept of the "average other person." Two of the six measures deal with normative sorts derived from the Q-sorts of self and of average other person as performed by a group of adjusted persons. Fifty self-referring statements were used in the Q-sorts. These items were sorted by each subject for each of the three concepts above. The measures involving these concepts are:

1) The self-ideal correlation (between Q-sorts for concepts of self and of ideal self).

2) The self-perceived other correlation (between concepts of self and of average other person).

3) The ideal-perceived other correlation (between concepts of ideal self and of the average other person).

4) The self-normal self correlation (between Q-sorts for the subject's self concept and a sort representing the average of the self-sorts of a group of adjusted persons).

5) The self-normal other correlation (between Q-sorts for the concept of self and a sort representing the average of the average other person sorts of the same group of adjusted persons).

6) The perceived other-normal other correlation (between the subject's Q-sort for the concept of the average other person and the normal other sort above).

These measures are considered in terms of their possible relationship to Rogers' 1951 definition of maladjustment. While none of these correlations directly measure the process of denial to awareness postulated by Rogers to be the source of maladjustment, they could easily reflect changes in the inter-relationships between different segments of the subject's perceptual field

consequent upon maladjustment. The self-ideal correlation, previously studied by others, was given special attention in the discussion of related studies.

In order to measure the capacity of these measures to discriminate an adjusted from a maladjusted group, the Q-sort items were administered to male VA hospital patients. The adjusted comparison and normative groups were composed of random halves of 50 patients from medical and surgical wards whose physicians indicated that these patients were not suffering from psychiatric difficulties. The maladjusted group (N = 56) was composed of patients from neuro-psychiatric wards and consisted of three sub-groups: a) 19 psychotics, b) 20 neurotics, and c) 17 character or personality disorders. In the adjusted group, the normative half was used for the construction of the normal self and normal other sorts.

The discriminatory ability of each measure was assessed by testing the significance of the difference between the mean group correlations on each measure. One comparison was between the adjusted group and the psychiatric groups, both as separate groups and in combination. The other comparison was among the sub-groups alone. The four measures that significantly discriminated the adjusted group from the psychiatric sub-groups, singly and in combination, were the self-ideal, self-perceived other, self-normal self, and self-normal other correlations. Although not significant, there was a slight tendency suggested for the psychotics to obtain lower mean correlations on these four measures than the neurotics did, as well as a tendency for the neurotics to obtain lower mean correlations than did the group of character and personality disorders.

A number of limitations of the study such as a lack of random selection of subjects, absence of controls, statistical difficulties, etc., were discussed. With these limitations in mind, the following tentative conclusions were offered:

1) The self-ideal, self-perceived other, self-normal self, and self-normal other correlations are capable of discriminating maladjustment as measured in this study, but the ideal-perceived other and perceived other-normal other correlations are not. From this data we may tentatively conclude that:

2) The maladjusted and adjusted subjects tended to perceive the ideal self-similarly, but the maladjusted subjects perceived themselves as much more unlike this ideal.

3) The maladjusted and adjusted subjects tended to perceive the average other person similarly, but the maladjusted persons perceived themselves as much more unlike this concept.

4) Both the maladjusted and adjusted subjects tended to see the concepts of ideal self and of the average other person similarly.

5) Thus the maladjusted subjects tended to perceive themselves differently than did the adjusted subjects and the maladjusted subjects perceived themselves differently than the adjusted subjects perceived the concept of the average other person.

Two explanations were considered as applicable to the above conclusions:

A. The maladjusted subjects tended to make a realistic appraisal of the relationship between themselves and others.

B. The maladjusted subjects had a lower level of self-esteem than did the adjusted subjects.

Suggestions for possible future research involving different kinds of Q-sort items and different conceptual objects were suggested. 92 pages. $2.00. Mic 58-5052

PERCEPTIONS OF SELF AND OF NORMALITY IN SCHIZOPHRENICS

(L. C. Card No. Mic 58-2282)

Margaret Joen Fagan, Ph.D.
The Pennsylvania State University, 1958

The purpose of this study was to investigate theories of personality dynamics in schizophrenia by measuring perceptions of the self and ways of viewing normality expressed by schizophrenics. The instrument was a Q sort, constructed from items based on theoretical ways that schizophrenics perceive themselves, view other people, and see their relationships to others. A preliminary Q sort was administered in a pilot study and 84 items showed sufficient reliability and interpersonal variability to be used in the final study.

The subjects were 20 hospitalized male schizophrenic veterans. The Q sort was administered twice, each subject first being instructed to sort the statements so as to describe himself, and on the next day to answer as he thought a normal person would.

The responses to the self sort and the normal sort were both correlated inversely, and each matrix was factor analyzed and the resulting arbitrary orthogonal axes were rotated to simple structure. The rotated factor loadings were correlated with the subjects' responses to each item, and the items with the highest correlations were used in naming each factor and determining its nature.

Five factors were extracted from the matrix of perceptions of self. Factor I_s, in which the subjects tried to present a very healthy picture of themselves, was named defensive denial of malajustment. Subjects heavily weighted on Factor II_s admitted many feelings of worthlessness, but described other people as kind and fair, resulting in a conception of the self as bad and inadequate with dependency upon others. Factor III_s subjects were mostly concerned with denying that they perceived themselves as bad or as failures, expressing a denial of guilt and self-doubts. Factor IV_s was characterized as showing extensive malajustment in every area. Factor V_s subjects seemed interested in other people, but found them confusing. This factor seems to represent superficial relatedness with little understanding of other people.

There seemed to be some relationship between Factors I_s and IV_s and Factors II_s and III_s. These pairs of factors seemed to represent basically similar perceptions of self, but subjects in Factors I_s and III_s were able to deny or repress unpleasant aspects of themselves, while subjects in the second and fourth factors admitted these perceptions.

It was felt that factors obtained from nonschizophrenic subjects would differ from the ones obtained in this study,

which seemed to agree with and support theories of types of personality structure found in schizophrenia.

Four factors were obtained from the matrix derived from perceptions of normality. Factor I_n indicated that some schizophrenics perceive the normal person as finding other people accepting and understanding, and tending to comply with their wishes, characterized as other-directedness. Factor II_n described the normal person as self-assertive and not caring much about other people. This factor was named aggressive individualism. In Factor III_n, the subjects described the normal person as having much self-assurance and enjoying life, showing exuberant self-confidence. Factor IV_n subjects indicated that the average person has little confidence in himself and gives in to others, showing timid dependency.

These four factors seemed to be similar to four of Fromm's descriptions of personality orientation, and do not seem to differ greatly from stereotypes of normality held by many nonschizophrenics.

Although some individual subjects tended to describe themselves and the normal person in similar ways, there was no relationship between factorial types of self perceptions and the types of perception of normality.

A comparison of the factors describing the schizophrenic self-concept, and factors obtained from a study of maternal attitudes of mothers of the subjects used in this study, revealed some relationship between the attitudes toward child rearing expressed by the mothers and the way that their schizophrenic sons viewed themselves.

90 pages. $2.00.

THE UNDERLEARNING AND OVERLEARNING OF MATERNAL STANDARDS IN THE ETIOLOGY OF NEUROSIS

(L. C. Card No. Mic 58-2283)

Harry Allen Grater, Ph.D.
The Pennsylvania State University, 1958

Objectives

The objectives were to determine whether well adjusted and poorly adjusted college females could be differentiated by any of the following: (1) Their moral and ethical standards of behavior. (2) Their behavior in situations involving a moral or ethical judgment. (3) The moral and ethical standards of behavior which the daughter perceived her mother as holding for a college female. (4) The moral and ethical behavior standards the mother holds for college females. (5) The frequency of conflict between the daughter's behavior standards and the perceived maternal standards. (6) The frequency of conflict between the daughter's behavior and the perceived maternal standards. (7) The frequency of conflict between the daughter's and mother's standards. (8) The frequency of conflict between the daughter's behavior and the maternal standards.

Procedure

Single, white, protestant, females who had reached sophomore or junior standing at Michigan State University were selected for study. A list of behavior standards important to this population was obtained by sending a questionnaire to a group of college females asking them to list the moral or ethical behavior standards important to their age group. The items collected were used to form three scales. Each scale contained the same items, but the subjects were asked to respond in three ways. First they were asked to indicate whether they felt the behavior described by each item would be morally or ethically right or wrong for a college female. Second they were asked to indicate whether they felt their mothers would consider the behavior described as morally or ethically right or wrong for a college female. Third they were asked to indicate whether they had engaged in the behavior being described.

These scales were administered to one hundred subjects. An item analysis was performed. Sixty-four items were found to be discriminating and were used in the final scales.

These scales were administered to a population of one hundred and thirty-six subjects. The Minnesota Multiphasic Personality Inventory was administered. Subjects who scored in the top third of this population on the hypochondriasis scale of the MMPI were placed in a hypochondriacal group. And identical procedure was used to form depressive and hysterical groups. The remaining subjects formed the non-neurotic group.

Scales were sent to the mothers of the subjects. They were asked to indicate whether they felt the items described behavior which would be morally or ethically right or wrong for a college female.

Results

There were no significant differences between the neurotic and non-neurotic groups in the number of items on the scale that they indicated were morally or ethically wrong. Nor was the behavior of the neurotic groups different from the behavior of the non-neurotic groups in situations involving a moral or ethical judgment.

The subjects in the hysterical group perceived their mothers as considering significantly fewer of the items as morally or ethically wrong than did the subjects in the non-neurotic group. The same tendency was found when the other two neurotic groups were compared with the non-neurotic group, but the differences were not significant.

Mothers of the hysterical subjects indicated that they considered fewer of the items as morally or ethically wrong than did the mothers of the non-neurotics. The same tendency was found when responses of the mothers of the subjects in hyprochondriacal and depressive groups were compared with the mothers of the non-neurotics; however, the differences only reached the ten per cent level of confidence.

The mothers and perceived mothers of the neurotics considered fewer of the items as morally or ethically wrong than the mothers of the non-neurotics, the conflict scores obtained were thus meaningless.

107 pages. $2.00.

THE RELATIONSHIP OF PERSONAL ADJUSTMENT TO REALISM OF EXPRESSED VOCATIONAL PREFERENCE

(L. C. Card No. Mic 58-2236)

John Francis Kinnane, Ph.D.
Columbia University, 1958

It was the purpose of this study: (a) to evaluate the reality content of the expressed vocational preferences of twelfth grade boys; (b) to investigate how realistic and unrealistic boys appraise themselves with reference to certain personal characteristics; (c) to investigate the differences in personal adjustment between realistic and unrealistic boys. The subjects were twelfth-grade boys from Middletown, New York.

Measures of adjustment were the Guilford-Zimmerman Temperament Survey (the trait approach), the Rotter Incomplete Sentences Blank (the projective approach), and the Bills Index of Adjustment and Values (the phenomenological approach). The last named instrument provided measures of self-attitudes in terms of (a) concept of self, (b) concept of ideal-self, and (c) the absolute differences between concept of self and ideal-self.

The main task was to devise a method of comparing these measures of the individual with external reality. In terms of a vocational preference, this involved the assessment of the degree of similarity between individual characteristics and the occupational requirements of the preference. The theory underlying the process of vocational development by which self and reality interact was based on Ginzberg's theory of a process of compromise, on Small's theory of ego strengths and needs, and on Super's role theory formulations.

The reality content of expressed vocational preferences was assessed by (a) the similarity of the individual's profile of tested abilities to the occupational ability profile of his expressed vocational preference; (b) the similarity of his expressed vocational preference and his measured interests. A composite criterion was also devised.

Results of the study would indicate that, for high-school seniors, the following conclusions are justified:

1. Realism of expressed vocational preference, as judged by personal criteria of realism (ability and interest), is not related to the hypothesized personality traits. The exception to this conclusion involves traits which suggests a self orientation rather than a social orientation.

2. Realism of expressed vocational preference, as judged by the combined criteria, is not related to the hypothesized traits. In considering this lack of relationship, it has been pointed out that the multiple cut-off technique is admittedly a crude method of combining criteria.

3. Realism of expressed vocational preference, as judged by any criterion, is not related to personal adjustment as assessed by a projective measure of conflictual behavior and psychopathological tendencies. It is possible that while the individual's perception of his reality status, as indicated in his expression of a vocational preference, reflect his personality traits as inferred from self-descriptions, they do not reflect the more deep-seated tendencies inferred from his projections. These underlying drives may not be available to the awareness of the high school boy in late adolescence when he expresses a vocational preference.

4. Realism of expressed vocational preference, as judged by abilities, is positively related to self-acceptance, but not when realism is judged by interests. However, realism as judged by abilities and by interests is positively related to favorable self-evaluations. It would appear that when the relationship between realism and personality is examined through the self-concept, the more realistic individual is one who has organized and synthesized his picture of his abilities and interests, so that these are compatible and can be implemented in his expressed vocational preference.

5. These specific findings justify the general conclusion that realism of expressed vocational preference is positively related to favorable self-attitudes. Realism of preference does not appear to be related to the hypothesized personality traits, the exceptions being those traits which suggest a self orientation rather than a social orientation. Realism of preference as judged by abilities is related to personal adjustment to the extent that self-acceptance is a measure of adjustment. However, realism of preference, as judged by any criterion, is not related to personal adjustment as assessed by a projective measure of conflictual behavior and psychopathological tendencies.

120 pages. $2.00.

ACCEPTANCE OF SELF, OTHER PEOPLE, AND SOCIAL CONFORMITY AS EFFECTS OF GROUP THERAPEUTIC EXPERIENCES

(L. C. Card No. Mic 58-2284)

Wilma Jones Knox, Ph.D.
The Pennsylvania State University, 1958

The effect of group therapeutic experiences on chronic hospitalized schizophrenic patients was investigated in the present study. Two types of therapeutic experiences, a therapy group which functioned under eclectic therapy techniques and a social group which conducted luncheon meetings, were contrasted with each other and with a control group on three variables: self acceptance, acceptance of other people, and conformity to a group standard.

Twenty-seven chronic schizophrenic patients considered to be in partial remission were assigned in random fashion to one of the three treatment conditions, therapy, social, or control. The subjects were white male patients between the ages of twenty and thirty-seven, without demonstrated evidence of organic brain damage, mental deficiency, or sociopathic tendencies.

All subjects were tested individually three times. The pretesting session, held before the experimental period, consisted of a photograph sorting task and two Q-sorts, a self sort and an ideal sort. Following the pretesting session the groups were formed and a six-week experimental period ensued. The therapy and social groups met three times a week; the control group received only routine hospital care. At the end of six weeks the posttesting session was held, and the tasks of the pretesting session were repeated. The follow-up testing session, consisting of a conformity test, was held a few days after the posttesting session.

The first hypothesis was that subjects in the therapy and social groups would show greater gains in self acceptance than control subjects. Greater self acceptance

was to be demonstrated by increases in the correlation of an individual's self and ideal sorts from pretesting to posttesting session.

The second hypothesis stated that subjects in the therapy group and social group would demonstrate a pattern of changing self concepts and stable ideal concepts more than control subjects would. Higher correlation between the two ideal sorts than the two self sorts for each subject was viewed as evidence confirming the hypothesis.

The third hypothesis stated that subjects in the therapy group and social group would show greater gains in acceptance of others than the control group. The measure of acceptance of others was a photograph sorting task in which subjects judged photographs of people as friendly or hostile. Fewer ratings of photographs as hostile in the posttesting than in the pretesting session was interpreted as demonstrating more acceptant attitudes toward other people.

The fourth hypothesis stated that subjects in the therapy group and the social group would conform to a presented group standard to a greater degree than control subjects. The test of conformity consisted of presenting some pictures from the photograph sorting task to each subject in a situation where he could either retain his former rating or change his opinion to conform to the group standard. Number of opinion changes to conform to the group standard was interpreted as the degree of conformity shown by the subject.

The pictures in the conformity test were so selected that an equal number of pictures rated hostile and pictures rated friendly were presented to each subject. It was predicted that subjects in the therapy group and social group would be influenced to change hostile ratings more often than the control subjects.

The pictures in the conformity test were selected to include an equal number of ambiguous pictures showing little inter-judge agreement and consensus pictures showing more inter-judge agreement. Opinion change on ambiguous pictures was interpreted as demonstrating a more rational approach to the task. It was hypothesized that the therapy group and social group would use a rational approach more often than the control group.

The results of the experiment were as follows: 1. Evidence at the criterion level of probability (.05) was not produced, and the conclusion was offered that the therapeutic conditions in the present experiment did not produce greater gains in acceptance of self than the control condition. 2. Changes in self concepts and retention of ideal concepts were not produced. 3. No significant differences among the three groups were obtained in acceptance of other people. 4. Evidence of differences in conforming behavior was not found. Group members did not conform to a group standard more often than control subjects. Group experience did not result in more changes of hostile ratings. Subjects with group experience did not show a more rational approach to the task than control subjects.

108 pages. $2.00.

EMPATHY RELATED TO REAL SIMILARITY, GROUP IDENTIFICATION AND INTERPERSONAL ATTRACTION

(L. C. Card No. Mic 58-2239)

Robert Byron Mills, Ph.D.
Columbia University, 1958

It was proposed that the accuracy of judges in an empathic situation can be predicted through two independent measures of the judge's personality which act as contributors to predictive accuracy:

1. degree of "real similarity" between judge and subject; i.e., degree of concordance of their self-descriptions.
2. degree of "real group identification" between the judge's expressed "typical" norm for a given group and the subject's proximity to that norm.

In addition, it was proposed that subjects liked by judges show more "real similarity" to the judges than those disliked, and that liked subjects are more accurately predicted. Judges identified as self-rejecting are expected to reverse the general trend; "real similarity" is negatively related to liking, and self-rejecting judges predict less accurately than other judges.

A five-choice adjective rating scale of 14 common personality traits (such as "dominance," "warmth," and "impulsiveness") was designed, along with a 16-item set of subjective statements constituting a "Like-Dislike" Scale, a modification of which served to measure self-rejection. A group of 20 student nurses served as judges. Judges listened to 15-minute edited recorded interviews of four subjects unknown to them (also student nurses), in which subjects described themselves in general areas covered by the rating scale. Judges then predicted self-responses of the four subjects, and reacted on "Like-Dislike" Scale to each subject.

Procedures were repeated after a two-week interval; test-retest reliability of adjective rating scale was .82, and reliability of "Like-Dislike" Scale was .715. A correlational analysis of data was made, with each judge's self-ratings and ratings of a "typical student nurse" serving to define "real similarity" and "real group identification" individually for each subject.

The effect of "real similarity" upon predictive accuracy was not adequately demonstrated in the study. The only positive indication was that 18 of 20 partial correlations showed "real similarity" to have had a positive effect upon predictions, and this was found to be significant. By contrast, the group stereotype of the "typical student nurse" was shown to be powerful for both judges and subjects, indicating a massive, shared view of a group norm of personality. A tendency was seen for superior judges to perceive individual cues in making accurate predictions, while almost all variance in the predictions of poor judges was accounted for by group identification. This trend did not prove to be statistically significant.

Liked subjects were not shown to be different from "disliked" subjects in degree of "real similarity" or predictive accuracy, as was predicted. With a four-fold classification, differences between extremes of "liked-similar" and "disliked-dissimilar" subjects again failed to show significance.

Self-rejecting judges did not dislike subjects who were similar to themselves, nor did they predict less accurately than other judges, as was predicted. The self-rejecting

judges showed some qualitative signs of unstable self-images, expressed more dislike for subjects, and disliked more subjects than other judges.

It seemed apparent that homogeneity and in-group loyalty of the judges had strengthened the group stereotype to the point that attribution of self-traits by judges was little used, having been supplanted by the massive, shared view of a "typical student nurse." Results of the study could be generalized only to highly homogeneous group situations of a similar type. 103 pages. $2.00.

RESPONSE DIFFERENCES BETWEEN PROCESS AND REACTIVE SCHIZOPHRENICS AS INDUCED BY MAGAZINE PHOTOGRAPHS

(L. C. Card No. Mic 58-2330)

John Mark Reisman, Ph.D.
Michigan State University, 1958

On the assumption that changes in motivation occur as symptoms persist over long periods of time, it was hypothesized that reactive schizophrenics would avoid while process schizophrenics would not avoid photographs considered to represent areas of frustration, conflict, and/or threat.

To test this hypothesis, thirty-six male hospitalized veterans diagnosed as schizophrenic were classified as reactive and thirty-six as process. A comparison group consisted of thirty-six male veterans hospitalized for physical ailments and not considered psychotic. The three groups were controlled for age, IQ estimates, and length of hospitalization. The experimental task was to sort an ordinary deck of playing cards onto a board divided into quadrants for eleven trials. On trials 1 and 9 - 11, subjects were requested to sort fast. From trials 2 - 8, subjects were allowed to sort fast or slow under one of four conditions: FP subjects were told they would see pictures after each trial during which they sorted fast; SP subjects were to see pictures after each trial during which they sorted slowly; FL subjects were to see a light turned on after each trial during which they sorted fast; SL subjects were to see a light after each trial during which they sorted slowly. Fast and slow were defined in relation to the subject's speed on the immediately preceeding trial. The pictures were magazine photographs, mainly of people, previously judged by five clinicians as to whether they represented an area of frustration, conflict, and/or threat. Pictures so judged were presented first, in sets of five, when appropriate. The light was a small flashlight bulb. It was predicted that reactives would sort cards so as to avoid seeing pictures while process would not.

In a sub-experiment, ten process and ten reactives who performed under the light conditions were used as subjects. A pile of 33 pictures was presented to each subject who was told to simply look at them for as long as he liked. Eleven of these pictures were photos of people judged to represent an area of frustration, conflict, and/or threat; eleven were photos of people judged non-threatening; eleven were photos of scenery or inanimate objects. It was predicted that process subjects would look at the three types of pictures for about the same length of time but that reactives would look at pictures judged threatening less than the other two types.

Generally, the results supported the hypothesis. As was predicted, reactives who sorted under FP were slower than under any other condition. They saw significantly fewer pictures than process subjects and less than would have been expected from their performance under the light conditions. Reactives were significantly more variable under FP and SP than under FL or SL. In the sub-experiment, reactives looked at photographs for a significantly shorter period of time than process subjects. As was expected, non-threatening and inanimate photos had a significantly positive effect on the length of time that reactives looked at pictures but there was no differential effect with process subjects. It was also found that the sorting time differences between the groups, normals sorted faster than reactives who sorted faster than process subjects, seemed to be more a reflection of differences in motivation than of a deficit in psychomotor ability in schizophrenia.

The major conclusions with respect to the population employed were:

1. Schizophrenics may be fruitfully divided into process and reactives.
2. Reactive schizophrenics avoid pictures considered to represent areas of frustration, conflict, and/or threat while process schizophrenics do not.
3. Duration of symptoms is a crucial variable in the investigation and understanding of schizophrenia.

90 pages. $2.00.

SOME PERCEPTUAL CORRELATES OF ANXIETY

(L. C. Card No. Mic 58-2243)

David Leonard Rosenhan, Ph.D.
Columbia University, 1958

Chairman: Joel R. Davitz

This study was concerned with the relationship between the degree of perceptual activity and the tendency to express anxiety at either the psychological level or at the viscero-somatic level. It was predicated on sensory-tonic theory, and on the psychoanalytic concepts of delay of gratification. Specifically, it was hypothesized that a positive relationship exists between the degree of perceptual activity and the reported experience of anxiety; a negative relationship exists between the degree of perceptual activity and the viscero-somatic expression of anxiety; and that the preferred mode of anxiety expression is also related to perceptual activity.

The subjects were hospitalized, male, acute schizophrenics who were less than 42 years old and had attained at least eight years of education. All of the subjects were receiving ataraxics. The subjects were given self-report inventories of viscero-motor and psychological anxiety, and tests of perceptual activity and fantasy capacity. In addition, ratings of behavioral anxiety were obtained from ward personnel.

The results indicated that Ss with greater perceptual activity seemed to be more aware of their anxiety than those with lesser perceptual activity. They did not, however, indicate that particular modes of anxiety expression (psychological or viscero-somatic) are related to the degree of perceptual activity.

Several hypotheses were offered to account for the failure of the results to conform to theoretical expectations. It was felt that perhaps the ataraxics affect not merely the level of anxiety, but also the manner in which it is expressed, and the awareness of anxiety. In addition, it was suggested that the results may have been vitiated by the relative unreliability of the instruments purporting to measure perceptual activity, and by the possible unwillingness of the subjects to admit to their anxiety in a hospital setting. It was also pointed out that since schizophrenia is presumed to be the result of an intense and inescapable anxiety, this anxiety may have invaded both motor and fantasy channels and, destroyed the consistent manner in which anxiety might be expressed in nonpsychotic persons.

Finally, some doubt was raised regarding the applicability of sensory-tonic theory and delay of gratification concepts to the problem of anxiety, inasmuch as anxiety is the result of conflict between incompatible wishes and sets.

A negative relationship found between the degree of perceptual activity and length of hospitalization was interpreted to mean that extended hospitalization may have a corrosive effect on self-awareness and introspectiveness.

A positive relationship was found between years of education and the tendency to express anxiety at the viscerosomatic level. It was speculated that since intelligence is related to years of education, this finding might indicate that the more intelligent were more willing to admit the anxiety symptoms on the self-report inventory.

54 pages. $2.00.

PERSONALITY VARIABLES AND STUDENT-CENTERED LEARNING EXPERIENCES IN EDUCATIONAL PSYCHOLOGY CLASSES

(L. C. Card No. Mic 58-2100)

William Joseph Ruzicka, Ph.D.
The Ohio State University, 1957

It was the purpose of the study to investigate student-centered learning experiences in six educational psychology classes at the Ohio State University.

The general hypothesis can be stated as follows: The degree of accomplishment of the student in the educational psychology course is directly related to his readiness to learn in those particular student-centered learning experiences which constitute the core of the course. The primary questions to be answered are the following:

1. Do the three objectives in the educational psychology course differ significantly from each other?
2. What combination of personality variables can best predict success in reaching each of the objectives?

A secondary problem will also be studied:

3. Is the instructor variable an important factor in the learning process of the students?

The six criterion variables were grouped under three objectives as follows:

OBJECTIVE	VARIABLES
A. Knowledge of facts and principles	Textbook quizzes
B. Habits of thought	Case study: Murray Mursell (MM) Case study: Mary Dembrowski (MD)
C. Attitudes and values	Minnesota Teacher Attitude Inventory (final) Educational psychology evaluation (final) Evaluation of instructor

Factor analysis of the six criterion variables produced two factors, course achievement and pupil evaluation, composed of the following measures:

Factor I (Course achievement)	Factor II (Pupil evaluation)
1. Textbook quizzes	1. Evaluation of course
2. Case study: MM	2. Evaluation of instructor
3. Case study: MD	
4. MTAI (final)	

The composite correlation between factor I and the criterion variables was .79; between factor II and the criterion, .65.

Thus, it would appear that the three proposed objectives are not significantly different. Accordingly, knowledge of facts and principles, its application to case studies, and attitudes about child development and discipline are highly interrelated and can be brought together under one factor, viz., course achievement. Likewise, evaluation of the course and evaluation of the instructur--two of three measures of attitudes and values--can be brought together under another distinct factor, viz., pupil evaluation. Therefore, instead of three objectives, there appear to be empirically only two: course achievement and pupil evaluation.

The Wherry-Doolittle method was used in selecting the following tests as the best composite predictors of successful course achievement (factor I):

Factor I (Course achievement) Predictors
High general psychology grade
High Minnesota Teacher Attitude Inventory (initial)
High Ohio State Psychological Examination (total)
Low "lie" score (SA-A Inventory)

The multiple R for these four predictors with the measures of factor I was found to be .66.

The following tests were selected, again by the Wherry-Doolittle method as being the best composite predictors of high pupil evaluation (factor II).

Factor II (Pupil evaluation) Predictors
High educational psychology evaluation (initial)
Male sex
Group procedure preference
Low Ohio State Psychological Examination (total)
Fraternity-sorority affiliation

The multiple R for these five predictors with the measures of factor II was found to be .63.

Although some of the results were inconsistent, analysis of variance of the six classes for each of the six

criterion variables revealed that students who rated both the course and the instructor high had an instructor who scored low on the stability scale and high on the MTAL Students who rated both the course and the instructor low had instructors with the opposite qualities. There were no consistent differences in instructors for the four measures of course achievement. The level of aspiration score was the only student personality variable which consistently differentiated between the extreme classes for the two measures of pupil evaluation (low level of aspiration being correlated with high evaluation).

An eight-variable cluster, distinct from the personality and criterion variables, was considered to be a measure of the internal and external consistency of one's self-other ratings. 80 pages. $2.00.

ATTITUDES OF MOTHERS OF SCHIZOPHRENIC PATIENTS

(L. C. Card No. Mic 58-2285)

Irma Lee Shepherd, Ph.D.
The Pennsylvania State University, 1958

The purpose of this study is to investigate the attitudes of mothers of schizophrenic patients toward children and family life in order to delineate patterns of motherhood which may be associated with the development of schizophrenia in their children. A factor analytic approach is used since it offers an effective method of placing subjects into groups showing common attitudes, from which basic patterns of motherhood can be seen and conceptualized.

The subjects used in this study were 20 American born mothers of male schizophrenic patients in a Veterans Administration Hospital. The research instrument consisted of 100 items representing a broad coverage of attitudes toward parent-child relationships and family life. These items were selected after pretesting to meet criteria of reliability and variability. The subjects were asked to sort each item to indicate whether they strongly agreed, mildly agreed, mildly disagreed, or strongly disagreed with the content.

One hundred and ninety Pearson product-moment correlations were computed from the responses of the twenty subjects. The 20x20 matrix of correlations was factor analyzed. Five factors were extracted by Thurstone's centroid method and the resulting arbitrary reference axes were rotated to simple structure. The rotated factors were correlated with each subject's responses to the items and the fifteen items with the largest correlations were used for interpretation of each factor.

Factor I, Detached authoritarianism, describes the subject who is primarily concerned with herself as a mother than her child and her way of relating to him. She handles her anxiety over her role by demanding perfection, obedience and exaltation from the child in order to reassure herself that she is a good mother. She cannot allow the child democratic consideration in the home since this would weaken her authoritarian role towards him. Such a relationship with the child used mainly to enhance the mother's needs precludes any deep emotional involvement.

Factor II, Inadequacy and inconsistency, seems to describe the mother to whom motherhood is primarily a sacrifice of all her own enjoyment. She feels insecure in her role and does not get adequate help from her husband. She deals with children inconsistently and ineffectually which can only be confusing to them and interpretable as subtle rejection.

Factor III. Pervasive control. High weightings on this factor indicate a strong emphasis on maternal control of every aspect of the child's life. She demands early toilet training, suppression of sex and aggression, high achievement, obedience and respect, allowing him no independence or privacy, even of thoughts, thus fostering intense dependency and hostility.

Factor IV. Sophisticated denial of inadequate mothering. The subjects high on this factor deny having any feelings of inadequacy in marital or maternal roles or difficulty in relating to or handling children. The subjects highest on this factor are women with education and business experience above the mean for the group which suggests a sophisticated effort to give the "right" answers.

Factor V. Annoyance and rejection. Factor V describes dependent, anxious mothers who are easily irritated by their children. Children are dealt with by harshness or ignoring and are discouraged from bothering parents with their problems and worries. They must repay maternal sacrifice by consideration and gratitude.

The second problem in this study investigated the relationship of the patterns of maternal attitudes to the self-concepts of the schizophrenic sons of the subjects. A correlational analysis of the factors described above and those extracted in a parallel study of the responses of the sons indicated that there were some relationships between maternal attitudes and the way in which schizophrenic sons viewed themselves and others. 93 pages. $2.00.

EXPRESSED ACCEPTANCE OF SELF AND OTHERS IN PSYCHOTHERAPISTS

(L. C. Card No. Mic 58-2478)

Julian Warren Streitfeld, Ph.D.
Columbia University, 1958

The purpose of the present study was to test directly the hypothesis that better psychotherapists are more accepting of others and more self-accepting than poorer psychotherapists. Self-acceptance was included with acceptance of others since the theoretical relationship of the two had been confirmed by research. Six hypotheses were formulated concerning the therapists' self-acceptance and acceptance of others, and three hypotheses concerning the interrelationships among measures.

The subjects were 79 graduates and graduate students of clinical, counseling, and school psychology who were finishing or had taken the Individual Counseling practicum at Teachers College. Their psychotherapeutic ability was rated by their supervisors, as was the therapeutic movement of each of the clients seen by the Ss just finishing the practicum. The Ss also rated their own psychotherapeutic ability and the movement of each case. Berger's scales of expressed acceptance of others (AO) and expressed self-acceptance (SA) were used as measures of acceptance of others and self after they had been checked for reliability and discriminative ability in a pilot study of a sample of the population used in the present study.

The results showed that the three hypotheses concerning the interrelationships among measures were confirmed. Supervisors' ratings of Ss' psychotherapeutic ability were positively related to their ratings of the case movements. Subjects' self-ratings of their psychotherapeutic ability were positively related to their highest and mean ratings of case movements. Subjects' scores on AO and SA were positively related, confirming Berger's findings.

Five of the six hypotheses concerning the relationship of AO and SA with psychotherapeutic ability were rejected, and the sixth one was accepted at the .05 level. Additional analysis of the data also failed to support the main hypothesis.

It was concluded that the results of the present study did not support the hypothesis that better psychotherapists are more accepting of others or more self-accepting than are poorer psychotherapists. There appears to be no relationship between acceptance of self or others and psychotherapeutic ability. The possibility was presented that if acceptance really is a necessary part of the therapeutic process, it may be that the better psychotherapist is able to be accepting of his clients or patients during the therapeutic hour, without necessarily being accepting of all people, in general, at all times.

Limitations of the study in terms of the rating scales, the Berger scales, and the level of psychotherapeutic training of the subjects were discussed. These limitations led to suggestions for future research.

The major suggestion for future investigations arising from the present research is that studies which are concerned with the effects of the therapist's personality upon the therapeutic process might study the behavior of the therapist and the features of his personality which are, or would be, manifested in his role as a psychotherapist.

78 pages. $2.00.

A STUDY OF DEATH ATTITUDES IN THE GERONTIC POPULATION AND THEIR RELATIONSHIP TO CERTAIN MEASURABLE PHYSICAL AND SOCIAL CHARACTERISTICS

(L. C. Card No. Mic 58-2165)

Wendell Monson Swenson, Ph.D.
University of Minnesota, 1958

Major Adviser: Starke R. Hathaway

In this study it was hypothesized that there exists a death attitude construct in the gerontic population, and that its relationship to such characteristics as age, education, physical condition, latitude of interest, home living conditions, and religiosity could be demonstrated.

A group of 210 gerontic subjects from homes for the aged, golden-age clubs, and industries employing older people were used in the study.

A 35 item death attitude check list was empirically developed and used, together with a rationally devised 5 step death attitude rating scale, to separate the 210 subjects into groups--those looking forward positively toward death, those evading any reference to death, and those fearing death. These different death attitudes were related to the above-mentioned physical and social characteristics.

Using chi-square contingency tables for the determination of relationship, religiosity, as measured by a religiosity scale on the Minnesota Multiphasic Personality Inventory, and intensity of religious activity were found to be closely associated with death attitudes--the positive or forward-looking death attitudes being found most frequently in the actively religious group. Individuals living in homes for the aged were found to look forward to death more positively than did non-institutionalized gerontics. Living alone tended to be associated with a fear of death. The well educated individual was found to face the problem of death more directly than the less educated by either looking forward to death or fearing it--the less educated tending to evade reference to death. Individuals engaging in relatively large numbers of activities were found to actively avoid any contemplation of the death experience. Those in poor health tended to look forward to death, whereas those in good health tended to avoid any contemplation of it. No relationship was found to exist between death attitudes and age, sex, socio-economic status, or rural-urban differences.

Of the 210 subjects tested, 95 cooperated in completing a valid MMPI. The median profile for this group is a mildly neurotic one with scales 0, 1, 2, and 3 being found most frequently as high points. There is an absence of evidence of psychotic or behavior disorder tendencies. Scales 4 and 9 appear frequently as low points in the profile. Approximately 25% of the males and 30% of the females have profiles with T scores of 70 or greater on at least one scale, suggesting that this group is generally more abnormal as defined by the MMPI scales than so-called normal adults. No relationship was found to exist between death attitudes and the MMPI scales.

127 pages. $2.00.

OCCUPATIONAL CHOICE IN SCHIZOPHRENIA

(L. C. Card No. Mic 58-2248)

Eugene Herbert Walder, Ph.D.
Columbia University, 1958

This study was concerned with realism of occupational choice in schizophrenia.

It was hypothesized that reality and wish preferences and self-estimation of capacities are less realistic in schizophrenics than in normals, and that admission schizophrenics are less realistic than remission schizophrenics.

Three groups of 25 subjects designated as admission and remission schizophrenics and normals were used. The subjects were white, male, native-born Americans between the ages of 20 to 45 and having at least an eighth grade education. Reality and wish preferences were obtained from standard stimulus questions. The General Aptitude Test Battery provided the measures of abilities. Estimates of Worker Trait Requirements for 4,000 Jobs provided ratings of job requirements. A five-level scale was developed to measure self-estimates.

The hypothesis that reality preferences are less realistic in schizophrenics than in normals was tested for the deviations between abilities and job requirements of the reality preference, and between job requirements of past occupations and job requirements of the reality preference.

It was concluded that occupational choice is unrealistic in schizophrenia. The hypothesis that wish preferences are less realistic in schizophrenics than in normals was tested for the deviation between abilities and job requirements of the wish preference. It was concluded that the vocational desires of schizophrenics are less bound by reality than are the wishes of normals. The hypothesis that self-estimates are less realistic in schizophrenics than in normals was tested for the deviation between abilities and self-estimates. The conclusion was that the appraisal of their own capacities is accomplished with less success by schizophrenics than normals.

The conclusions were related to elements of psychological theories of occupational choice and schizophrenia. The compromise theories of occupational choice were considered especially relevant in the focus which they afford for the compromise between subjective and objective, fantasy and reality, factors. It appears that schizophrenics cannot make the compromise required for realistic occupational choice because of deficiency in reconciling inner needs and external demands. The distorted picture of the self and personal resources was considered the result of the basically weak self-esteem and the fluid functioning of the ego. The formal elements of the complementary theoretical frameworks of Bleuler and Cameron were related to unrealistic choice. It was considered reasonable to assume that occupational choice in schizophrenia falls under the influence of autistic thinking and the facts of reality are discorded and distorted. Also, the conclusions were explained in terms of the disarticulation with reality in schizophrenia leading to the distortion of the self and occupational roles. Further verification of the relation of autism and desocialization to unrealistic occupational choice was considered necessary.

The relation to Small's study was considered briefly and it was concluded that personality adjustment is a powerful determinant of occupational choice for adolescents and adults.

An approach to counseling oriented toward the strengthening of the ego and enhancement of reality testing was proposed.

The failure to find differences between admission and remission schizophrenics was attributed to the biased admission sample in the direction of less disturbance and greater accessibility to reality.

The auxiliary hypotheses were discussed briefly and it was suggested that the real and the unreal are not completely merged in the schizophrenic samples, and that even when treatment had been successful in moving patients toward discharge, occupational choice remains unrealistic.

The exploratory analysis of the direction of reality deviations suggested that the schizophrenic may aim far below the level justified by his personal resources as often as he overextends himself.

The limitation resulting from assigning equal weights to the job requirements was discussed. 57 pages. $2.00.

THE EFFECT OF WORK ON THE CHRONICALLY ILL AND AGED: A STUDY OF THE EFFECT OF SHELTERED WORKSHOP EMPLOYMENT ON THE PERSONAL ADJUSTMENT OF A HOSPITALIZED GROUP OF CHRONICALLY ILL AND AGED PEOPLE

(L. C. Card No. Mic 58-2133)

Morton Zivan, Ph.D.
New York University, 1958

Chairman: Professor Roland H. Spaulding

The purpose of this investigation was to determine the effect of sheltered workshop employment on the personal adjustment of a hospitalized group of chronically ill and aged people. Two matched groups of twenty patients each were selected as subjects from among the patients at the Bird S. Color Memorial Hospital and Home. One group was employed in the hospital sheltered workshop; the other group was denied work for the duration of the study.

The duration of the study was three months. Both groups were evaluated before and after the experimental three-month period of work or denial of work. The subjects were evaluated by means of the Adult Attitude Inventory section of Your Activities and Attitudes (an instrument which was constructed especially for use with the aged) and by interviews which dealt in further detail with the areas covered in the Inventory and also dealt with the nature of the subjects' hospital adjustment. The evaluations yielded data which were subjected to quantitative and qualitative analyses.

On the basis of certain characteristics, the two study groups were essentially similar at the beginning of the study. Testing and interviewing also revealed no significant differences between the two groups.

In their reasons for wanting to work, both groups emphasized their need for something more to do in order to overcome their loneliness, idleness, purposeless existence, and monotonous environment.

At the end of the three-month experimental period, the working group was significantly ahead of the non-working group in all but two of the areas studied. The two areas which were less sensitive to change were "economic security" and "religion".

The areas in which the working group surpassed the non-working group were health, friends, attitude toward work, feelings of usefulness, and happiness.

At the end of the experimental period, the working group felt better, was less preoccupied with physical symptoms, and was more optimistic about the future.

The working group made a more favorable adjustment to fellow patients and developed more positive attitudes toward friends generally.

The working group showed the most significant improvement in "attitude toward work". The group emphasized the value and pleasure of work.

The members of the working group had greatly heightened feelings of usefulness. They developed greater ability to help themselves and others, and took great pride and encouragement from this increased ability.

At the end of the study, the members of the working group were generally happier and looked forward to continued life, while the members of the non-working group were depressed and expressed death wishes.

The working group gave the impression of people moving

forward with increased hope and confidence regarding the future. The non-working group gave a picture of people standing still or moving backward with little hope and much despair.

The results of the study indicate that the addition of work to the program of chronically ill and aged hospital patients will assist these patients to achieve a more favorable personal adjustment than similar patients will achieve without work. 146 pages. $2.00.

PSYCHOLOGY, EXPERIMENTAL

UTILITY AND LEVEL OF ASPIRATION: EXPERIMENTAL TEST OF LEVEL OF ASPIRATION THEORY IN A DECISION-MAKING CONTEXT

(L. C. Card No. Mic 58-2286)

Selwyn William Becker, Ph.D.
The Pennsylvania State University, 1958

The purposes of this research were (a) to test the empirical validity of the assertion that a person's level of aspiration is associated with the least upper bound of the largest distance on his ordered metric scale of utility of various goals on an achievement scale; and (b) to increase the sensitivity of measurement while testing level of aspiration theory regarding the effects of success and failure by predicting changes in level of aspiration based on a higher ordered metric measure of utility of goals on an achievement scale.

Experiment I[1]

Twenty-three students in an introductory statistics course volunteered to gamble with their instructors for their grades on a forthcoming midterm examination rather than to take that examination. Each subject's ordered metric scale of utility of the grades A, B, C, D, and F was derived from his choices between alternative sets of probability combinations of grades. By a ruse, each subject "won" a C as his midterm grade. Subjects who expressed dissatisfaction at this outcome were interviewed individually; the information yielded by the interview permitted an independent estimate of each subject's level of aspiration. On the basis of the interview material, the experimenters agreed closely in their rankings of the interviewees from high to low level of aspiration: reliability coefficient = r_s = .99.

Two hypotheses were tested. Hypothesis IA was that those subjects who do not wait for an interview will be students on whose ordered metric scales of utility the largest distance is between D and F. This was confirmed: four students did not wait for an interview, and each was found to have an ordered metric scale on which the largest distance was between D and F. Hypothesis IB was that there will be a positive correlation between students' levels of aspiration as expressed in the interviews and their levels of aspiration as given by their scales of utility of grades. This was also confirmed: the correlation between the two independently obtained indices of level of aspiration was r_s = .83.

Experiment II[1]

Twenty-eight students in an introductory statistics course volunteered to gamble with their instructor for one-fifth of their grades on a forthcoming midterm examination. Each subject's higher ordered metric scale of utility of grades A, B, C, D, and F was derived before he wrote his examination. After the examinations were corrected, each subject received knowledge of the letter grade he "earned" on that examination. A second expression of each S's higher or ordered metric scale of utility of the grades A, B, C, D, and F was then obtained. The following two hypotheses were tested:

Hypothesis IIA was that the ordered metric measure of level of aspiration of persons who change their levels of aspiration after achieving at one or more letter grades above their previously measured levels will indicate a raised level of aspiration; those who change after achieving at one or more letter grades below their ordered metric measure of level of aspiration will evidence a decreased level of aspiration. Eight students showed changes on their second ordered metric measures of level of aspiration and all eight were in the predicted direction. The significance of these changes was tested by the Sign Test, p = .004.

Hypothesis IIB was that the higher ordered metric measure of level of aspiration of persons who achieve at one or more letter grades above their previously measured levels will indicate a raised level of aspiration; those achieving at one or more letter grades below their previously measured levels of aspiration will evidence a decreased level of aspiration. Changes in level of aspiration rank were tested for significance by the Wilcoxon matched-pairs signed-ranks test and the hypothesis was accepted, $p < .03$. 149 pages. $2.00.

1. After both experiments were completed, the purposes, techniques, and results were explained to the two classes. Every student understood that no course grade would be influenced by the experiment.

FIGURE-FRAME INTERACTION WITH TACHISTOSCOPIC EXPOSURE

(L. C. Card No. Mic 58-1642)

Cecil Calvert Bridges, Jr., Ph.D.
The University of Texas, 1958

Supervisor: Dr. Harry Helson

Seventy-seven figure and frame combinations of simple geometric forms were presented to ten Os with a tachistoscope. The figure-frame combinations were drawn to test the effects of the properties of frames on perceived figures at threshold. Os reproduced the figure-frame combinations following tachistoscopic exposure. Only an ascending series of exposure times was used. The main results were as follows.

Location - Tangency of Figure and Frame: Circular figures tangent to circular frames have higher thresholds than comparable non-tangent configurations in which the figure is centered. Circular figures tangent to their circular frames are reproduced with a typical assimilative distortion.

Location - Partial Identity of Figure and Frame: The difference between the threshold times of square and triangular figures which are well segregated from their frames on the one hand, and partially identical to them on the other, is not statistically significant. There is, however, a consistent type of sub-threshold distortion in the case of the partially identical figure and frame: the figure tends to be drawn complete and separate from the frame.

Orientation - Axes of Symmetry: In certain configurations the importance of the alignment of axes of symmetry is overwhelming. In one case its effect is not significant. In general, misaligned axes of symmetry of figure and frame lead to greatly lengthened threshold times, and typical distortions toward symmetry in sub-threshold reproductions.

Geometric Form of Figure and Frame: The differences between the threshold times of circular, square, and triangular figures in circular, square of triangular frames are not statistically significant unless one takes into account the orientation of the figure in the frame. In the cases where the figures are tilted, the form of the exterior figure is an important determinant (see "Axes of Symmetry") insofar as the orientation of the several axes of symmetry of the different geometric figures varies.

Size of Figure: The larger a figure is, the shorter the threshold time. In this case, no interaction between figure and frame was demonstrated; the largest figures which were not well segregated from their frames were the easiest to perceive, and frames were usually seen earlier in the ascending series than the figures they contained. Apparently, mere size is an important determinant of perception speed.

Closure of Figure and Frame: There is considerable difference between the cases in which the frame is closed and the cases in which the frame is open, but there is no significant difference between those cases in which the frame gap is paralleled by a figure gap, and those in which the frame gap is on the side opposite from the figure gap. However, considering only the cases in which frame and figure gaps are contiguous, it makes a great deal of difference whether the gaps are located in the corner of a configuration or on the side. Those reproductions of figures with corner gaps have markedly higher threshold times. In this case the figure is reproduced with an extra short line segment, making it similar to the frame in form.

The perceived form of the figure is not determined in a simple way by the frame, but by the relation of the figure to the frame, e.g. none of the frames of different forms led to significantly different threshold times if the frame alone was considered; tilting the figures in the frames produced no significant differences in threshold times if tilted and untilted means alone were analyzed. The relational aspects of figure and frame which are shown to be overwhelmingly important are the location of the figure relative to the frame, and the relative orientation of the figure and frame axes of symmetry. 80 pages. $2.00.

AN EXPERIMENTAL ANALYSIS OF THE EFFECTS OF INFANTILE SHOCK-TRAUMA

(L. C. Card No. Mic 58-2341)

Kenneth Harold Brookshire, Ph.D.
University of Oregon, 1958

Adviser: Richard A. Littman

The purpose of this study was to investigate the nature of the effects of infantile shock-trauma, and to assess the behavioral generality of those effects.

In Experiment I six groups of ten animals each were exposed to a severe electric shock for five successive days during infancy. The conditions under which shock was administered were varied for each group. Two groups of ten animals served as non-shocked controls. Later in life all subjects were trained in a runway apparatus to avoid electric shock. The results indicated that (a) Ss trained to escape shock (by running) in infancy were superior to all other groups; (b) Ss exposed to shock but given no escape training displayed greater efficiency than controls in making avoidance responses but were less efficient than controls when required to respond while the shock was on.

In Experiment II eight animals were assigned to each of three groups. These groups were either shocked, handled or ignored in infancy. Later in life all subjects were tested for activity, urination and defecation in a strange environment. No significant differences were found between groups.

Experiment III utilized 30 subjects. As infants these Ss were either shocked, handled or ignored, as in Experiment II. At 100 days of age Ss were trained on an elevated runway to obtain food. Half of each group was trained under mild (23-hour) deprivation, the other half under a more severe deprivation schedule. It was found that the performance of ignored Ss was inferior on Day 1 in both sub-experiments, with no differences between shocked and handled subjects. Under the severe deprivation schedule, the results indicated that the running scores of shocked animals became inferior late in training, shortly before death occurred by starvation.

Incidently, data were collected on the relative weight of shocked, handled and ignored subjects. It was found that exposure to shock created a significant reduction in weight gain, but that this reduction was only temporary. By adulthood no weight differences were found between groups.

These results were interpreted as indicating that (a) small degrees of infantile handling have an insignificant effect on adult behavior; (b) infantile shock-escape training benefits the organism, if it is exposed to a similar situation later in life; (c) infantile exposure to shock, without opportunity to escape it, lowers the emotional threshold of the organism in such a way that it is affected later in life when exposed to stressful situations; and (d) depending upon the requirements of the test situation, early traumatization may improve or hinder the performance of the animal. 110 pages. $2.00.

THE EFFECTS OF PREDEFINED STIMULUS PROPERTIES ON PROJECTIVE STORY-TELLING

(L. C. Card No. Mic 58-2287)

Howard I. Low, Ph.D.
The Pennsylvania State University, 1958

Three predefined physical stimulus properties were used as a means of experimentally studying their effect upon story-telling responses. Four response measures were logically deduced from the demands imposed upon subjects by story-telling instructions. It was reasoned that stimulus effects were a joint function of instructions and physical stimulus properties. The former delimited the kinds of responses expected from subjects independent of the pictures used, and consequently supplied response measures for the present study. The latter determined the way in which these response expectations could be met by subjects, and therefore affected the distribution of responses among pictures.

Eight predictions were made and tested on the basis of this logic by having 80 male college students write stories about eight experimental pictures containing two male figures, among which one or more stimulus properties were distributed. These three stimulus properties were activity, emphasis, and faces. Active characters were depicted as appearing to act upon the other pictured characters. Emphasized characters were depicted as appearing to be the phenomenological center of interest of the picture. Two different faces represented the third independent variable, one of which was characterized as protective, and the other characterized as helpless.

Each of the 80 stories were scored by two staff members and eight advanced psychology graduate students on four response variables. These four measures were represented by interpersonal and noninterpersonal activity, and feeling-contemplation toward the self and toward others. The mean reliability coefficients obtained were .87, .83, .80, and .73.

A 2x2x2 analysis of variance design was used to test the effects of the three stimulus properties on response measures. In addition, the effects of instructions upon the measures were determined descriptively since the data lacked the independencies needed for an analysis of variance.

Six of the eight predictions were confirmed. Only those having to do with feeling-contemplation toward others were insensitive to stimulus effects. It was found that stimulus properties and instructions appeared to have differential effects on story-telling responses. Thus, the data gave support to the notion that stimulus effects are the joint function of both story-telling instructions and the physical stimulus properties of pictures. The former may delimit the kinds of responses expected from subjects, and the latter may determine the way in which these responses are distributed among the pictures.

The results of this experiment also gave clear-cut evidence for the differential effects of predefined stimulus properties on story-telling responses. The data supported the proposition that the behavior affecting the relationships between characters is largely a function of stimulus properties. It was found that the structure of these relationships varied directly with the stimulus attributes of the characters, so that there was no support given to the notion that idiodynamic predispositions of the story-tellers affected these kinds of relationships.

Consequently, questions arise about the appropriateness of existing picture-story techniques, and the effectiveness of the projective hypothesis and interpretations based on it. Previous studies have also raised similar questions. The results of the present study encourage re-evaluating projective methods, especially many of the untested but propogated assumptions. The method of predefining stimulus properties developed in this study appears applicable to some of these problems.

135 pages. $2.00.

SOME EFFECTS OF SET AND STIMULUS PROPERTIES ON THEMATIC APPERCEPTION TEST STORIES AND ON RESULTING CLINICAL JUDGMENT

(L. C. Card No. Mic 58-2288)

Bernard Lubin, Ph.D.
The Pennsylvania State University, 1958

The purposes of the present study were to investigate certain of the effects of set and stimulus properties on selected aspects of TAT response and to investigate the effects of set on the judgmental accuracy of clinical psychologists.

A sample of 60, white, male freshmen were randomly selected and were tested in a 3x2 factorial covariance design. The stimuli consisted of two TAT cards which elicit sexual expression and two TAT cards which elicit aggressive expression. In addition, two TAT cards which elicit low sexual and aggressive expression were used to pretest all subjects in order to provide adjusting measures for the covariance analyses. Sets were produced by differential instructions which sought either to facilitate or inhibit response. One group was told that spontaneity and individuality of stories were indicators of good adjustment and maturity; the other experimental group was told that constraint and conformity were indicators of good adjustment and maturity. A third group received neutral instructions.

The dependent variables were (a) response time, (b) productivity (two word counts), (c) creativity, (d) sexual expression, and (e) aggressive expression.

Each subject wrote for five minutes to each of three self-descriptive questions. Pretest cards 5 and 7BM were then administered with standard TAT instructions and the subject's stories were tape-recorded. Following this, the instructions and the two TAT cards which were appropriate to the randomized condition due at that session were administered.

The stories were transcribed. Three graduate students in clinical psychology rated all 240 stories on a six-point scale for aggressive expression, and on a six-point scale for sexual expression. Interjudge reliability was .84 for the aggression scale and .89 for the sex scale. Two graduate students in clinical psychology rated all 240 stories on a five-point scale for creativity. Reliability of rating creativity was .46.

Data for all measures except sexual expression were submitted to analysis of covariance. Since the regression of the test measure on the pretest measure was not significant for this variable, the data for sexual expression were submitted to analysis of variance.

In order to study the effects of set on judgmental accuracy, the following tasks were developed:

1. Six judges attempted to differentiate the instructions which had preceded the elicitation of the story.

2. Six judges attempted to differentiate the subjects by matching the first story elicited under the set-inducing instructions with the two stories which had been elicited under standard TAT instructions.

3. Six judges attempted to match the first story elicited under the set-inducing instructions with the answers to the three self-descriptive questions.

The plan of each task was that of a 3x3 block design. Each judge was used only once. Accuracy of sorting or matching was analyzed by analysis of variance.

The following conclusions were drawn:

1. Set is a determinant of sexual expression, aggressive expression, and creativity. Set is a determinant of the accuracy with which clinical psychologists differentiate the instructions, and, contingent on the nature of the judgmental task, set is also a determinant of the accuracy with which clinical psychologists differentiate the subjects. No evidence was found that set is a determinant of response time or productivity.

2. The stimulus properties of the TAT cards are determinants of sexual expression and aggressive expression. No evidence was found that stimulus properties are determinants of response time, productivity, or creativity.

3. The interaction of set and stimulus properties is a determinant of sexual expression, but this interaction did not prove to be a determinant of aggressive expression, creativity, response time, or productivity.

128 pages. $2.00.

AGE AND VOCABULARY TEST PERFORMANCE: A QUALITATIVE ANALYSIS OF THE RESPONSES OF ADULTS

(L. C. Card No. Mic 58-1358)

James H. Ricks, Jr., Ph.D.
Columbia University, 1957

The purpose of this study was to investigate whether and to what extent adults, as they get older, change in the way they define or identify words on a free-answer vocabulary test. The general hypothesis was that they do change in such ways that a systematic qualitative scoring of the responses would reveal significant differences between appropriate age groups, and that these differences would indicate change not adequately reflected in the usual vocabulary test score. The study was cross-sectional, change with age being inferred from differences among several age groups tested at the same time.

The Feifel-Green type of fivefold schema was used for classifying the responses; each answer was categorized as: 1) Synonym, 2) Use and description, 3) Explanation, 4) Inferior types, or 5) Error. It was hypothesized that older persons would give fewer synonyms and more responses of the use-and-description and inferior types than middle-aged and younger adults.

The word list used was the vocabulary subtest of the Wechsler Adult Intelligence Scale. The sample consisted of 671 persons tested in the course of the WAIS standardization, distributed in five age groups as follows: 151 aged 25-29, 164 aged 45-49, 110 aged 65-69, 104 aged 70-74, and 142 aged 75-up. Differences between the sexes were tested, found not significant, and disregarded.

Differences in mean score in each of the five categories were examined for statistical significance. As hypothesized, the older adults averaged significantly lower in Category 1, Synonyms, and significantly higher in Category 2, Use and description, and Category 4, Inferior types of response, than the younger persons. It had been known from previously available data that the older persons would score higher in Category 5, Errors, and this difference also was significant. The older groups scored lower in Category 3, Explanations, but the difference fell short of the .05 level of significance using a two-tailed test, and nearly disappeared when examined within restricted ranges of education.

The data were also presented for each age group divided into restricted ranges of vocabulary score and years of education. All categories except 4, Inferior types of response, showed clear relationships with these two control variables, but even within the restricted ranges there still appeared the decrease in synonym and increase in use-and-description and inferior types of response with advancing age.

The relationship of the qualitative scores to such criteria as highest grade completed and the quantitative vocabulary score showed synonyms to be superior to explanations, and explanations to be superior to use and description responses.

The results were interpreted as challenging the hypothesis that the vocabulary score of an older person can be seriously regarded as reflecting performance in which little or no real change has occurred since earlier adulthood. Rather, they support the contention that impairment does occur but is somewhat obscured in the case of free-answer vocabulary tests by the fact that a number of different kinds of response, some qualitatively inferior, may be scored as correct. 97 pages. $2.00.

SOME DEVELOPMENTAL AND OBJECTIVE FACTORS IN PERCEPTION

(L. C. Card No. Mic 58-2310)

Solomon Schneyer, Ph.D.
Syracuse University, 1958

Supervisor: Jerome J. Schiller

Transactional theory suggests that perception is a function of the observer's past experience with particular classes of stimuli. The present study attempts to test three hypotheses implicit in the theory, using the "rotating trapezoidal window," as follows: (1) within limits, non-veridical perception of the rotating trapezoid increases with age; (2) assuming that a trapezoidal figure cut out and shaded to look like a window is more likely to induce the assumption that the figure is actually rectangular than is a plain white trapezoid of the same size and shape, the cut-out, shaded trapezoid is more likely to be perceived non-veridically than is the plain white trapezoid; and (3) the differences in the veridicality of perception between

the two types of figures will be greater in younger than in older children.

Subjects consisted of the 75 second, fourth and sixth grade boys, 25 at each grade level, who passed a special screening test.

The experimental procedure required monocular observation at a distance of 7.5' of three simultaneously exposed figures which were either rotating through 360^0 (around their vertical axis) or oscillating through 180^0, independently of, but in phase with each other, at 3 RPM. In the two critical series of eight trials each, one of the rotating trapezoids was exposed in the center position, flanked by a rotating and an oscillating rectangle. The subject was required to report by flashing an appropriate indicator light, the flanking rectangle in which the motion matched that of the trapezoid. Scores represented the number of non-veridical pairings made by each subject with each of the two trapezoids.

In analysing the data, the .05 level of confidence was used as the criterion for statistical significance. No significant differences on any critical variable were noted between the fourth and sixth grade groups, so these two groups were combined. Significant age differences in the predicted direction were observed with both trapezoids, and the difference between the trapezoids was also significant and as predicted. The hypothesis of greater difference between trapezoid scores in younger than in older children was not confirmed. An interaction effect was noted between the type of trapezoid and the order of administration. In Order I (plain figure - shaded figure) the difference in scores was significant and in the predicted direction, in Order II (shaded figure - plain figure) the difference was not significant. This effect was independent of age. The interaction effect was paralleled by a difference in reliability in the two orders of administration. For the total group the corrected split-half reliability was .65. For Order I it was .78, for Order II, .50. These correlations are all statistically significant. The range of scores observed was highly restricted, probably resulting in an underestimate of reliability. The correlation between non-veridical perception and Otis IQ was not significant at either age level.

The results of the study appear to be largely consistent with predictions made from transactional theory. It is believed that the age differences observed involve real differences in perception rather than greater "error" in the younger group. It is suggested that the age and figure effects provide a set of "converging operations" which seem to offer support for the thesis that past experience is a factor in perception. Methodological problems of the study are discussed and an alternative method of approach is suggested which would serve to validate the present study and, together with it, provide another set of operations converging on the role of experience in perception.

150 pages. $2.00.

AN INVESTIGATION OF THE CONCEPT OF IMPULSIVITY

(L. C. Card No. Mic 58-2009)

Bernard Victor Verrill, Ph.D.
University of Houston, 1958

Previous approaches to the study of impulsivity have conceptualized it as a faculty within the organism, or as a general class of behaviors within a typological system. It was the purpose of this study to draw attention to the untested or untestable generalizations and assumptions underlying these approaches and to provide a restricted framework within which empirical studies could be carried out; Specifically, the study was intended to: (a) establish a criterion for impulsivity; (b) determine the extent to which indices previously inferred to be measures of impulsivity relate to this criterion; (c) determine the effectiveness of a new measure of impulsivity which was based directly on the criterion; (d) propose an approach to the construct validation of impulsivity.

The criterion used for impulsivity was a rating scale which included two specific characteristics: quickness of verbal response, and inappropriateness of verbal response. Five judges were used to rate a group of 53 college males. From those cases in which two out of two, or three out of four, judges agreed a total of 27 subjects were selected. Fourteen subjects were obtained for the "impulsive" group and 13 for the "deliberate" group. The two groups were then compared on the control variables of age and intelligence. No significant differences were obtained between the groups on these measures.

To obtain predictor measures of impulsivity the following tests were administered: (a) the Rorschach; (b) the Porteus Maze; (c) the Insight Test; (d) the IM Test; and (e) Murray's Impulsion-Deliberation questionnaire. All were individually administered with the exception of the Insight Test which, in some cases, was administered to small groups. The 12 measures taken from the Rorschach protocols had been identified in previous studies as measures of impulsivity. For the most part these measures involved the use of color responses or form responses. The average reaction time for the first response to each card was also included since this would relate to the characteristic of quickness included in the ratings. Two measures were taken from the Porteus Maze: performance time, and qualitative errors. Qualitative errors were developed by Porteus as a measure of "slovenliness" and impulsiveness. The scores of "action" and "qualification" were taken from the Insight Test because Sargent inferred these to be measures of impulsivity and control of impulsivity, respectively. The IM Test was developed specifically for this study; the scores of time and "number of clues utilized" correspond to the characteristics of quickness and inappropriateness used in the ratings. Murray's Impulsion-Deliberation questionnaire yields scores on the number of impulsion and deliberation statements accepted by the subject as being typical of himself.

In an attempt at construct validation of "impulsive" and "deliberate" the Edwards Personal Preference Schedule was administered and measures of the following traits obtained: achievement, deference, order, exhibition, autonomy, affiliation, intraception, succorance, dominance, abasement, nurturance, change, endurance, heterosexuality, and aggression.

Of the 31 predictor measures utilized, 23 significantly differentiated the "impulsive" and "deliberate" groups at the .05 or better level of confidence. Of the eight factors on the Rorschach which significantly differentiated the groups, four involved the use of color responses. It was proposed that the emphasis on color responses among the "impulsive" subjects might be more of a reflection of their attitude toward the testing situation than of their "emotional lability." Both the scores of "action" and "qualification" from the Insight Test differentiated the groups, but the latter was of greater statistical significance. It was suggested that "qualification" may be more accurately interpreted as a measure of "appropriateness" than of control of "basic impulses" as proposed by Sargent. Scores from the Porteus Maze -- performance time and qualitative errors -- also significantly differentiated the groups. Since these measure motoric reactions it was proposed that the "nomological network" for the concept of impulsivity might include a number of motoric, as well as verbal, behavioral patterns. Results from the IM Test and Murray's Impulsion-Deliberation questionnaire were interpreted as lending further support to the view that the characteristics of quickness and inappropriateness of verbal response differentiate "impulsive" from "deliberate" subjects.

On the basis of the Edwards it was discovered that the "impulsive" group is significantly higher on the trait of interception while the "deliberate" group is significantly higher on the traits of deference, affiliation, and nurturance. It was inferred that these differences may reflect a differential constellation of learned social behaviors for the individuals within the "impulsive" and "deliberate" groups. Thus, the characteristic pattern for the "deliberate" subjects was identified as a special sensitivity to the feelings, attitudes, expectancies, etc. of others. Conversely, subjects within the "impulsive" group were presumed to be characterized by a relative insensitivity to the feelings, attitudes, expectancies, etc. of others; they were identified as evidencing an "intraceptive" orientation. It was further proposed that these constellations may well relate to what Allport refers to as "altruism" vs. "self-seeking." 73 pages. $2.00.

A COMPARISON OF PRAGMATIC ELEMENTS IN SECULAR ETHICS WITH ELEMENTS OF PRAGMATISM IN CONTEMPORARY PROTESTANT INTERPRETATIONS OF CHRISTIAN ETHICS

(L. C. Card No. Mic 58-2472)

Charles Evans Morton, Ph.D.
Columbia University, 1958

This dissertation analyzes the differences between the basic assumptions of the pragmatic ethics of William James and John Dewey and the Christocentric interpretation of ethics in Emil Brunner and Reinhold Niebuhr. It attempts to show how the ethics of Brunner and Niebuhr incorporate attitudes and procedures similar to those of pragmatism, by rejecting dogmatism, by insisting on the relativity of moral achievements, by seeing in God's love the ultimate norm of human behavior which cannot be reduced to a manageable law, and by insisting that moral reconstruction be pursued experimentally in the light of the norm of moral action.

Chapter I describes both the theological reconstruction which contributed to the growth of pragmatic procedures in the ethics of contemporary Protestantism and the development of a newer naturalism which contributed to the emergence of these procedures in the ethics of pragmatism.

Chapter II and Chapter III discuss basic differences between the assumptions of pragmatism and the current expression of Protestant ethics with regard to the nature of man, the origin and nature of the ethical problems, and the norm of ethical behavior.

While Chapter IV is concerned with differences between the position of Brunner and that of Niebuhr, Chapter V attempts to show how a deeper insight into the uniqueness of the law of love together with a profounder understanding of universality and persistence of sin in human life are factors involved in the shift toward pragmatism in the ethics of Brunner and Niebuhr.

Chapter VI compares the experimentalism of pragmatism with the procedure of Brunner and Niebuhr in the area of moral reconstruction. Faith in the sufficiency of the method of intelligence and the rejection of force as a possible means of intelligence distinguish the approach of pragmatism to social reconstruction from the pragmatic realism of Brunner and Niebuhr. Chapter VI is also concerned with the function of art and religion in the moral life. Dewey describes art as integrated experience which directs moral activity by showing what undistorted experience may become. He rejects the position of James which maintains that religion is an unique experience that supports the strenuous mood in morality. For Dewey, religion is a function of the moral imagination which unifies values already realized in experience. Moral growth results when intelligence relates ideal ends to actual experience in a way that augments and deepens the unification of values. Brunner and Niebuhr interpret the suggestive functions of art differently. They believe that art assists the improvement of moral life in so far as it shows the need for redemption and moral regeneration. They further assert that religion improves the moral life when it is understood as the response of man to God in whom life finds unity.

Chapter VI, the conclusion, summarizes the findings of this study and suggests that ultimately the choice of assumptions in any approach to ethics is determined by one's prior belief concerning the purpose of life. The author believes that a Christocentric ethics, like that of Brunner and Niebuhr, cannot maintain its integrity by accepting the assumptions and goals of pragmatism. But it may use the refined technique of the latter's procedure to determine how the neighbors' best welfare can be fostered in the complexity of modern society. To have some knowledge of the probable consequences of one's action, provides a more intelligent base for determining the most appropriate step one should take in line with whatever is regarded as the norm of moral behavior. Procedural similarities between pragmatism and the major expression of Protestant thought provide the possibility for mutual improvement of social strategy. 177 pages. $2.35.

A LITERARY AND EXEGETICAL STUDY OF THE EIGHTY-NINTH PSALM

(L. C. Card No. Mic 58-2480)

James Merrill Ward, Ph.D.
Columbia University, 1958

The first objective is to provide a detailed commentary on the text itself. The dissertation therefore contains a new translation based on a critical examination of the Hebrew text and the ancient versions, a study of the literary form of the psalm and a critique of earlier theories of composition, and a verse-by-verse exegesis. Word-studies are made of important terms such as "sons of God," "Yahweh of hosts," and "Rahab," with references to the Ugaritic parallels. The second major objective is to establish the literary and liturgical place of the psalm in Old Testament history. The history of interpretation of the Royal Psalms, of which this is one, is surveyed and a criticism of principal theories made, especially those of Gunkel, Mowinckel, Kraus, and Johnson. The history of the Davidic Oracle and its literary relations is studied, especially the affinities among Psalm 89, II Samuel 7, and I Chronicles 17. Finally, there is an attempt made to determine the likely historical and liturgical background of the psalm.

The unity of Psalm 89 is defended on the basis of the patterned repetition of key words, the probable liturgical intention of the psalm, and the relationship between poetic meter and subject-matter. While it is considered likely that the author drew upon his knowledge of poems used regularly in the royal cultus in Jerusalem, especially the psalms of Yahweh's enthronement and the Davidic Oracle,

the unity of the present psalm is vigorously championed. An early preexilic date for Psalm 89 is defended. It is placed with Genesis 49, Exodus 15, Deuteronomy 33, and Psalm 132 in the early monarchy. Evidence for this opinion is drawn from study of the literary relations of Psalm 89:20-38 in the Books of Samuel, Kings, and Chronicles. There is an increasing tendency in the later materials of the Old Testament to associate the dynastic promise with Solomon and the building of the Jerusalem temple. The absence of such associations in Psalm 89 attests to its high antiquity. Further, the study attempts to show that the desolation described in Psalm 89:39-52 represents the frustration of the exalted royal claims of the pre-exilic Davidides and is therefore priate to the catastrophes of the divided monarchy as to the Exile, with which the psalm is usually associated.

The opinions of such scholars as Engnell and Widengren which associate the royal psalms with the ritual of a dying-and-rising god, dramatically represented in the Jerusalem cultus by the king, are rejected. But a modified cultic interpretation is accepted, against such scholars as Gunkel, Kissane, and McKenzie. The theory that these psalms were employed in a covenant-renewal festival is accepted as possible but uncertain, but that Psalms 89 and 132 were used in a regularly repeated celebration of the dynastic oracle together with the episode of II Samuel 6, is deemed probable. Psalm 89:39-52 is taken to be a ritual celebration of the actual frustration of the dynastic claim to universal sovereignty and not as an artificial, ritual humiliation of the king. The realism of the Hebrew belief in the heavenly assembly (89:6-15) is defended, but the "sons of God" are taken as dependent creatures of God. It is also concluded that the Hebrew king was considered sacrosanct but not an incarnate deity. His superhuman powers and unique station were due to the activity of the spirit of Yahweh, which also set aside prophets and charismatic judges. And his autonomy was limited by the ethical conditions of the Davidic convenant (Pss. 89:31ff.; 72).

404 pages. $5.15.

SOCIAL PSYCHOLOGY

AN APPLICATION OF SOCIAL EXPECTATION THEORY TO THE INITIAL INTERVIEW

(L. C. Card No. Mic 58-1377)

Bruce Jesse Biddle, Ph.D.
University of Michigan, 1957

In this thesis a theory of social expectation previously devised for predicting success of influence was applied experimentally to the initial interview between clients and counselors.

Earlier studies have shown that when the other conforms to role-expectations held for his behavior by a person, the other will have more influence over the person than when he does not so conform. In the present study, this proposition is elaborated by means of a logico-deductive theory. The concepts of position, norm and role are defined. Expectation (an individual construct) is differentiated from norm (shared expectations) and perceived norm (an expectation for which the individual perceives consensus). Using these and other concepts, postulates are stated and theorems derived relating to social groups.

In applying this theory to the initial interview, hypotheses are derived relating to three independent variables; (1) Counselor behavior in the area of counselor focus in the initial interview. Such counselor focus might be either (a) on solving the client's problem, or (b) on forming a strong relationship with the client. (2) Client expectations for counselor behavior in the same behavioral area. (3) Relative power of the counselor to punish the client.

Among those hypotheses derived were: (1) Non-conformity by the counselor to percieved norms of the client for the counselor leads to less progress in all phases of the initial interview than does conformity. 2. Non-conformity by the counselor to expectations of the client for the counselor leads to less progress in the initial interview only if the counselor has high punishing power over the client. (3) The counselor who focuses on the establishment of relationship will be more successful in the initial interview than the counselor who focuses on problem-solving. (4) The counselor with high punishing power will be less successful in the initial interview than the counselor with low punishing power. These and other hypotheses were tested against 21 dependent variables of client reactions to the initial interview, change in client expectations, and perceived behavior of the counselor.

The experiments involved presenting groups of subjects with a play in which a counselor conducted a fraction of an initial interview with a client with whom subjects identified. Subjects consisted of 152 students of classes of Educational Psychology. The counselor presented was structured to be an advisor of theirs. Two experiments were used and were differentiated from one another in terms of the methods used for creating differential expectations. In one experiment, subjects were separated into groups in terms of existing expectations; while in the other, subjects were given "slanted" information tending to induce a desired perceived norm. Eight experimental groups were used in each design with two conditions of each independent variable represented. Data were collected from subjects both before and after seeing the play, and were treated by analysis of variance in a 2x2x2 factorial design.

Results indicated strong support for social expectation theory as a meaningful approach to the initial interview. The four hypotheses listed above were supported, with others, at varying levels of significance. It was also discovered that subjects were much more likely to distort perceptions of the counselor's behavior than they were to change expectations to conform to the actual behavior of the counselor.

375 pages. $4.80.

SOCIOLOGY, GENERAL

VALUES EXPRESSED ON COMMUNITY RELATIONSHIPS IN RECENT WESTERN SOCIAL THOUGHT

(L. C. Card No. Mic 58-2289)

David J. Gray Jr., Ph.D.
The Pennsylvania State University, 1958

The purpose of this study was to trace and establish a change in values with respect to community in recent western social thought. Beginning with the eighteenth century, the dominant strains of intellectual thought through the nineteenth century to the present time were examined.

The eighteenth-century "philosophes" proclaimed a profound faith in human reason. Societal perfection and the ultimate happiness of all mankind was viewed as being dependent on man's exercise of his unique capacity to reason. Since the individual human mind is the source of all reasoning powers, such a faith gave rise to a general philosophy of individualism and freedom from traditional community restraint. This confidence of the "philosophes" in the individual, his reason, and his self-sufficiency - which tended to undermine community relationships - was given renewed emphasis in the nineteenth century as the doctrine of classical economics emerged. It was observed, however, that two demurrers to this individualistic philosophy were made: (1) that of the philosophical conservatives, who emphasized the importance of tradition and the non-rational nature of social ties, and (2) that of the utopian socialists, who sought a new way to build society on the basis of rational social ties. Nevertheless, belief in individualism prevailed and, in fact, gained strength in the latter half of the century with the advent of Social Darwinism.

As the nineteenth century came to a close, however, laissez-faire philosophy began to encounter opposition. European social theorists began to call attention to the disintegration of community organization and relationships in the modern world. In addition, the development of the social survey movement, the aim of which was to revitalize community life, introduced an atmosphere of reform. The "muckraking" of certain American authors and journalists in the early twentieth century reenforced the demand for social change. The field of academic sociology, simultaneously, was taking form and the reform element was not lacking.

Thus, by the twentieth century, it was ascertained that a clear ideological shift had transpired. The eighteenth-century faith in the individual, in the twentieth, had been transferred to community. The lone individual, once viewed as the epitome of freedom, had become the symbol of anxiety and isolation. This current intellectual plaint is sounded in such titles as Escape From Freedom, The Quest for Community, and The Lonely Crowd.

Finally, it was noted that in very recent years a renewed emphasis on individualism has emerged. But the current plea is not for liberation from outmoded social institutions or community, but from, or within, the bureaucratically-organized life in which modern man is so deeply involved. 144 pages. $2.00.

THE HOSIERY LOOPER IN THE TWENTIETH CENTURY, A STUDY OF FAMILY OCCUPATIONAL PROCESSES AND ADAPTATION TO FACTORY AND COMMUNITY CHANGE, 1900-1950

(L. C. Card No. Mic 58-1850)

George Henry Huganir, Jr., Ph.D.
University of Pennsylvania, 1958

Supervisor: E. P. Hutchinson

STATEMENT OF THE PROBLEM:

This study involves an investigation of the work processes of a stable, female ethnic occupational group, its family structure in the community and the factory's organizational structure through the changing twentieth century. The problem lies within the framework of the effects of social and technological changes upon the behavior of a work group in a manufacturing situation--textiles. Specific derivative questions are: To what extent can a work group within a factory system maintain identification with and belief in its social norms in the face of social and technological changes in the community? What are the forms of resolution to value conflicts found in the work situation? To what extent can MILL authority impose new norms and/or adapt itself to the norms of a subordinate work group? What factors in the community influence the power of authority in the work place? To what extent do community family systems influence work group behavior in the work place? How do community changes affect work behavior changes in family units and the sequential influences of these (family work behavior changes) on a work place?

PROCEDURE OR METHODS:

Historical reconstruction of the group's occupational experiences was gained through intensive recorded interviews focused upon individual work-life histories. Early century work patterns were identified through the narratives of those in the group who entered the labor force as child laborers. Coupled with the work-group as informants were management level informants (active and retired) who provided information concerning the MILL's organizational and technological changes and their relations to changing socio-economic conditions in the local community. The objective data collected concerning workers family structure provided preinterview information on various experiential and vital areas of workers' parents, siblings, husbands, and children--nativity, occupations, residence, education, marital status, etc. Available MILL and

community records were also utilized for the MILL-Work Group-Community analysis.

RESULTS:

It was established that the work-group's functional continuity in the MILL was the effect of several factors; the close proximity of workers' families and the MILL, the existence of a MILL-family identity, and minor changes in the technical characteristics of the occupation. The occupation selected many children in the MILL "neighborhood" early in the century, and female work socialization processes in families were directly focused upon careers in the MILL. Since 1925 mother-daughter occupational succession has been less common; the increased educational levels of worker's daughters has inhibited interest in factory employment. The work-group has profited accordingly from the lessened competition with youth.

CONCLUSIONS:

The development of the work group over the century represents the effects of a rather continuous pattern of MILL, family, and neighborhood interaction.

The relative power and authority exerted by family systems and MILL organizational structure has varied during the century. It appears that the strength of one or the other has been a function of changing socio-economic conditions and changes in the community's authority over factory personnel utilization.

The status of the mid-century work group in the MILL skill hierarchy occupies a prestige position unrecognized in the local industrial community. This position in terms of MILL norms contributes to individualistic forms of work behavior. The status changes of the occupation have been affected by career-succession avoidance in recent years on the part of workers' children. 307 pages. $3.95.

A STUDY OF PROFESSIONALIZATION OF BUSINESS MANAGEMENT IN REAL ESTATE FIRMS

(L. C. Card No. Mic 58-2216)

Thomas P. Imse, Ph.D.
University of Maryland, 1958

Supervisor: Professor Harold Hoffsommer

The purpose of this study was to explore the suggested trend toward professionalization being made by the occupation of business management. The hypothesis which this study tested was: The occupation of business management, although it may exhibit some of the attributes of a profession, is not near to being professionalized. In the necessity to limit the area of the particular project it was decided to study managers of small firms and in doing this to focus upon the managers of real estate firms. All of the managers of real estate firms with five or more licensed salesmen in the Maryland suburban area of Washington, D.C. were interviewed. The interviews were based upon an "ideal type" of professionalized business manager which was developed from a carefully detailed definition of a profession. The definition and therefore the ideal type specified seven attributes of a profession. Four of these were categorized as usually present characteristics. The essential elements were:

1. A fund of specialized knowledge,
2. Standards of intellectual attainment in control of entry,
3. It affects the intimate affairs of others, and
4. The exercise of individual judgment by the practitioner.

The usually present characteristics were:

1. A code of ethics,
2. A spirit of altruism, and
3. Self-consciousness of the occupation and self-organization.

Each of the fifty-six managers was interviewed by the author, in the course of which each of the items of the ideal type professional business manager was explored to see whether or not the given manager manifested professional characteristics. It was found that the professional attributes which were present or which the managers strongly claimed to possess were those of the outward appearances of a profession, the usual characteristics. They wished to appear ethical and to show a spirit of altruism, although there was little self-consciousness of the occupation of management and little self-organization. On the other hand the essential elements of the occupations which are identified as professions were only slightly indicated if at all. There was no basic educational or experiential background held even more or less in common. There was no significant control of entry into the occupation or desire for such control on the part of the managers. Many managers even denied any intimacy of the affect of their actions on the affairs of others, something which professionals characteristically cite about themselves and which by definition is apparently true about business managers if they recognize it or not. It was concluded that the occupation of business management, as seen in the managers studied, is interested in attaining the outward appearances of and the respect of a profession, but that it is not now possessed of the essential elements of a profession. The hypothesis was confirmed by the data, therefore. 122 pages. $2.00.

CONTACTS AND ATTITUDES TOWARD THE UNITED STATES IN A MEXICAN BORDER COMMUNITY

(L. C. Card No. Mic 58-2363)

Julius Rivera, Ph.D.
Michigan State University, 1957

This study is concerned with describing the place which Mexican migrants to the United States have in a small isolated Mexican community close to the border. The research was initiated to test two general hypotheses. The first is that there is a relationship between amount of exposure to American society and the attitudes toward the United States. The second hypothesis is that membership in different socio-economic groups in the community differentiate attitudes of people toward the United States.

In order to test these hypotheses, it was necessary to construct two indices; one which measured relative amount of contact with the United States, and another which reflected the relative socio-economic status of residents on the community. Exposure to the United States was defined generally as including friendship and family ties in this country, length of time in the United States, as well as work contacts in the cities and farms. Three main groups were defined for their differential contacts with the United States; those whose only contact was indirect (through friends and relatives), those whose contact was in the nature of visiting and conducting business; and those who worked in the United States for extended periods (migrants).

There appeared to be no statistically significant differences in attitudes among migrants, visitors, and non-contact groups. As a whole, the residents of the community were favorably disposed to the United States. People with a greater amount of exposure to American institutions had a tendency, diffused as it was, to define themselves either as favorable or unfavorable toward the United States, with a leaning in favor of the United States. Among people with minimum contact with the United States, unfavorable orientations were readily recognizable.

Socio-economic status was found to be inversely correlated with favorable attitudes toward the United States. There was a relatively sharp distinction in which upper and middle class people were rather unfavorable toward the United States, whereas lower socio-economic groups were favorably oriented. Thus a cleavage in the community was apparent, in which the upper group looked toward Mexico in favorable light, and the lower group looked toward the United States. Also, traditional values in Mexican culture were more cherished by the local middle classes.

Two generalizations may be suggested in reference to migration. First, in the initial phase of migration, membership in lower socio-economic strata is almost a condition for migration. Second, the place of the returning migrant in the social structure of the community depends on his economic success while in the United States. His attitudes toward the United States after returning and after readjusting to the community tends to become similar to the socio-economic group of which he is a member.

189 pages. $2.50.

SOCIOLOGY, PUBLIC WELFARE

A STUDY OF JUVENILE COURT RECORDS IN PULASKI COUNTY, VIRGINIA, FROM 1934 TO 1954

(L. C. Card No. Mic 58-2223)

Lillian Lorena Smith, Ed.D.
University of Maryland, 1958

Supervisor: Dr. Madelaine Mershon

Statement of Problem. Pulaski County, Virginia, has been publicized as ranking first in the incidence of juvenile delinquency in the state. Whether or not there is a factual basis for the report, the rumor has served to alert the community to the importance of looking into the juvenile situation. A study of the problem has been suggested by various local groups and individuals.

It was thought that a description of the juvenile court records might furnish valuable data to community groups undertaking to study the extent and nature of the local problem prior to determining a method of community attack. It is the purpose of this report to present such descriptive materials.

Procedure. The data for this study were copied from the records of the Juvenile and Domestic Relations Court of Pulaski, Virginia, for the years 1934 to 1954. Developed from the types of information available in the records, the questions which this study attempts to answer are as follows:

I. To what extent has the court dealt with children in Pulaski County, Virginia, from 1934 to 1954? (number, age, sex, race, group offenses, recidivism)

II. What has been the nature of juvenile offenses referred to above court during this period?

III. What has been the disposition of the above referrals?

IV. What changes in the philosophy of the court are indicated by the above records?

To pin point the available information relating to the questions, graphs and tables have been devised for the twenty-year period to indicate the extent of the problem, for five or ten year periods to suggest trends, and for single years to compare with national experience. Since this is a descriptive study, the plan is to picture, as a group, the juvenile offenders, as described in the court records, with interpretations based on pertinent research, which, it is hoped, may indicate significant factors in the situation and implications for preventive action.

Findings. This study indicates that 1.78% of the child population of Pulaski County, Virginia, has appeared in court from 1934 to 1954, as compared with 3% reported at the national level. In 1953, there seemed to be a rise of 20%, exceeding the national increase by 7%, but the average incidence locally was .88% below the reported national figure. The most numerous age group reported was sixteen years. White children seemed to constitute 88.6% of the total and Negro children 11.4%. Boys appeared to outnumber girls approximately seven to one. A minimum of gang misconduct was suggested with a well defined trend away from group offenses. Recidivists appeared to constitute 28.4% of the referrals as compared to 25% reported nationally. It is indicated that 57.5% of juvenile misbehavior has been in the area of petty theft and acts of carelessness and mischief. The most frequent dispositions of cases seemed to be probation, which accounted for 24.5% of the referrals; dismissal; and referral to the Department of Public Welfare with a decided upward trend.

Change in the interpretation of juvenile delinquency in Pulaski County appears to have been in most respects consistent with national trends but following them a few years later. These trends seemed to move from identical treatment of adult and juvenile offenders to a complete separation exemplified in the organization of the juvenile court, and from punitive to protective treatment of young offenders. There were also indications of increasing faith in cooperative effort in the attack upon the problem of juvenile delinquency in Pulaski County, Virginia.

132 pages. $2.00.

THE PARLIAMENTARY SPEAKING OF JOHN PYM: 1621-1643

(L. C. Card No. Mic 58-2290)

Goodwin Fauntleroy Berquist, Jr., Ph.D.
The Pennsylvania State University, 1958

John Pym, the subject of this study, was England's first major parliamentary leader. Biographers and historians alike agree that Pym was an effective speaker, though there appears to be no detailed analysis of his speaking in print. The purpose of this study, therefore, was to try to determine the bases of Pym's effectiveness as a parliamentary speaker.

As a means of understanding the relationships which existed between speaker, speech, audience, and occasion, a study was made of the historical setting of Pym as a parliamentary speaker in Stuart England. This study included a biographical sketch of Pym's life; a historical sketch of the time in which he lived; an analysis of St. Stephen's Chapel and Westminster Hall, the principal places where Pym spoke; and a detailed treatment of Pym's particular relationship as a speaker to his listeners.

Thirty-five speech texts were then verified as genuine reports of speeches actually delivered by Pym. Earlier investigators had validated fifteen of these texts, and the writer corroborated twenty more by a careful comparison of contemporary sources.

The speech criteria selected for this study included elements of the speaker's invention, style, arrangement, and delivery. These criteria were chosen on the basis of the task involved and the available evidence. The treatment of Pym's invention included an analysis of his ideas, goals, modes of proof, and audience adaptation. The treatment of style, curtailed somewhat by the lack of verbatim speech texts, involved a discussion of Pym's choice and use of words, and of his sentence structure. Arrangement centered upon Pym's homelitic organization of ideas, and delivery was limited by available evidence to a treatment of Pym's manner of presentation, the physical factors conducive to his effectiveness, and his method of speech preparation.

Evidence that Pym was indeed an effective speaker included direct, immediate response to his speeches, contemporary estimates of his ability as a speaker, his remarkable ability to forecast future trends, the actual changes in belief and attitude caused by his speaking, and the discernible long range effects of his speaking.

The bases of Pym's effectiveness as a speaker were found to be the following: (1) Pym was a representative speaker for his interests largely coincided with those of his listeners; (2) Pym's reputation as a man of courage and integrity definitely contributed to his speech effectiveness; (3) Pym was skillful in blending old and new ideas, carefully grounding his proposals in precedents even when the proposals themselves were new; (4) Pym repeatedly adapted his ideas to those of his audience; (5) as a speaker, Pym was easy to follow due to his simple style, lucid organization, and restrained manner of delivery; (6) invariably Pym backed up his arguments with evidence, relying primarily upon logical proof to do so; and (7) Pym devised remarkable means of communicating his views to a reading as well as a listening audience. 205 pages. $2.70.

LISTENERS' AND READERS' RESPONSES TO POETRY

(L. C. Card No. Mic 58-2462)

Wallace Allison Gray, Ph.D.
Columbia University, 1958

The purpose of this study was to discover whether the responses of listeners are better than the responses of readers in (1) over-all understanding of a poem; (2) report of central meaning, central images, and metaphorical images; and (3) appropriate critical comments on the poem. The hypothesis was that the listener would be superior, since he had the advantage of the oral interpreter's techniques of analysis and communication, whereas the silent reader had to perform these tasks for himself.

The experiment involved the use of two Graeco-Roman squares for the randomization of the (1) visual and aural presentation of (2) four poems to (3) 48 college freshmen.

Methods of treating the data were analysis of variance; comparisons of means and standard deviations; and product-moment, point biserial, and phi coefficients of correlation.

Application of the conclusions must be made with the consideration that (1) the 48 students of the study were male college freshmen who were above the national average of students taking the College Board Entrance Examination, (2) the students read or listened to a poem only one time, and (3) listening to a tape-recording was not equivalent to the usual oral interpretation situation.

The conclusions were as follows: (1) there is no difference between readers and listeners in over-all understanding, response to central meaning, response to central images, response to metaphorical images, or appropriate critical comments on the poem; (2) within one poem, there are relations between over-all understanding, central meaning, central images, and appropriate criticism; and (3) over-all understanding related from one poem to another, whereas central meaning, central images and appropriate critical comments are not.

The conclusions led to the following implications: (1) the finding of no over-all difference between readers and listeners strengthens the implications of previous studies that neither mode of presentation is superior for communicating difficult material; (2) intelligence of the subjects may operate to mask any differences between readers and listeners: this lack of difference at the top level has

psychological significance for education as well as for Oral Interpretation of Literature; (3) the fact that one type of response is related to (and possibly dependent upon) other types of response underscores the importance of the oral interpreter's approach first to the whole, then to the parts, and again to the whole; (4) students get overall understanding of a poem regardless of individual idiosyncracies that may cause them to react to the specifics of one poem but not to another, i.e., poetry may succeed in spite of the individual because it contains suggestions to the senses and subtle arguments which analysis can at present only approximate; and (5) the question whether the listener would have an advantage over the reader with difficult prose or with extremely difficult poetry is still unanswered.

The findings of this study suggest that for short, difficult poems, within the means available for appraisal, the listener does not differ from the silent reader in (1) overall understanding; (2) response to central meaning, central images, and metaphors; and (3) appropriate critical comments on the poem. 50 pages. $2.00.

VOCAL RESPONSES TO DELAYED AUDITORY FEEDBACK IN CONGENITALLY BLIND ADULTS

(L. C. Card No. Mic 58-1814)

Ralph Jerome Schwartz, Ph.D.
Purdue University, 1958

Major Professor: M. D. Steer

This investigation was an exploratory study involving the effects of auditory alteration upon speech output when the sense modality of vision is congenitally absent. Subjects received two stories, one through listening and the other through silent reading (Blind subjects used braille). Recordings were made during impromptu retelling of the stories under synchronous feedback and delay conditions of .14, .18, and .22 second. Feedback levels of amplification were established by means of individual determinations of comfortable loudness. The speech variables measured were the following: phonation/time ratio, mean sound pressure level, standard deviation of the mean sound pressure level, and the frequency of major sound pressure level shifts (converted to an index of number of shifts per second).

Seventeen young adult males participated as subjects in the investigation. Seven of these persons, the Blind group, were recruited at the Indiana School for the Blind; and ten persons, the Sighted group, came from five sections of an introductory course in public speaking. All of the subjects were less than thirty years of age and none was younger than eighteen years. All received tests to determine that they had normal speech and normal hearing.

Resultant data were statistically analyzed by t test, analysis of variance, and the Newman-Keuls sequential range test. Within the recognized limitations of the investigation the following conclusions are offered:

A. There appear to be no appreciable differences between blind and sighted groups related to the selection of comfort levels for listening.

B. Under the conditions of the present investigation blind persons tend to have lower phonation/time ratios than do sighted persons.

C. Under the condition of synchronous auditory feedback the frequency of major sound pressure level shifts is generally lower among blind persons than among sighted persons.

D. There are no strong indications in the present investigation that blind persons differ from sighted persons in the over-all degree or magnitude of response to delayed auditory feedback, although this possibility does exist for frequency of major sound pressure level shifts and particularly for phonation/time ratio.

E. Observational evidence suggests that blind individuals, as a group, appear to be more influenced in phonation/time ratio at the .14 second delay interval than are sighted persons.

F. Comparison of data from pre-delay and post-delay conditions fails to disclose for either group any consistent pattern which can be identified as a persistence effect. Differences which do occur are not statistically significant (at the 5% level).

G. In general, performances of neither the Blind group nor the Sighted group appear to be notably influenced by the modality of stimulus presentation (listening or reading). A possible exception to this is the finding that decrease of P/T ratio on the first delay experience is predominantly associated with reading, whether visual or braille.

H. The variables and factors of the present study do not demonstrate interactions of statistical significance (at the 5% level). 243 pages. $3.15

THE EFFECT OF IONIZING AND ULTRAVIOLET RADIATION ON BIOLOGICAL ANTIOXIDANTS

(L. C. Card No. Mic 58-2291)

Albert Alcide Barber, Ph.D.
Duke University, 1958

Supervisor: Karl M. Wilbur

The antioxidant activity of various mammalian tissues was studied, and the effect of x-radiation and ultraviolet light on this activity was determined. The three systems utilized to measure antioxidant activity included: peroxide formation in liver homogenates, peroxide formation in methyl linolenate emulsions, and the autoxidation of dihydroxyphenylalanine (DOPA) to melanin.

Rabbit blood and bone marrow inhibited peroxide formation in liver homogenates as did rat intestinal mucosa, rat testis and mouse ascitic fluid. Antioxidant activity was greatest in tissues which formed no peroxides when incubated alone. Liver and brain which formed the greatest amounts of peroxides when incubated alone possessed no antioxidant activity as measured by the liver homogenate test system.

Blood and intestinal mucosa failed to inhibit peroxide formation in incubated methyl linolenate emulsions. It had previously been demonstrated that blood serum inhibits the oxygen uptake by these emulsions when both ascorbic acid and iron are present in the incubation mixture. In the present study no inhibition was noted when plasma or mucosa was added to emulsions containing only iron or only ascorbic acid.

The inhibition of DOPA autoxidation was studied to compare the antioxidant activity of tissues on some system other than a peroxide forming system. Rat mucosa, testis, brain, and liver inhibited DOPA autoxidation whereas blood was relatively inactive.

Chemical studies on the liver homogenate test system indicated that peroxide formation in liver homogenates involved a mechanism similar to the lipid-iron-ascorbic acid mechanism and that the inhibition of peroxide formation involved the interference with one of the components of this mechanism. The effectiveness of chelating agents in the inhibition of peroxide formation in liver homogenates indicated that tissue antioxidants may act by interference with metal catalysis.

The antioxidant activity of the intestinal mucosa on peroxide formation in liver homogenates was destroyed by 800 r of whole body x-radiation. None of the other tissues examined was so affected. The inhibition of DOPA autoxidation by the mucosa was not affected by similar doses of x-radiation and it was found that these mucosal preparations were very catalytic to methyl linolenate oxidation in the presence of ascorbic acid. These data suggested that the effect of whole body radiation was on the increased prooxidant activity of mucosa rather than the destruction of an antioxidant. The catalytic requirements of DOPA autoxidation and peroxide formation are very different and it is not surprising that DOPA autoxidation failed to respond to the prooxidant changes in the mucosa induced by the radiation. Previous investigators have noted increased peroxides in tissues of irradiated animals and this increased prooxidant activity may be one of the possible explanations for this rise.

The antioxidant activity of tissues was relatively resistant to both x-radiation and ultraviolet light in vitro. In vitro studies provided no information regarding the extreme sensitivity of the mucosa when irradiated in vivo.

Within tissues there appears to be a balance between prooxidants and antioxidants which determines the extent of peroxide formation. This balance represents the antioxidant capacity of a particular tissue and a change in either of the components would result in a change in this capacity. The destruction of the antioxidant capacity of the intestinal mucosa by whole body x-irradiation appears to be due to an increased prooxidant level. This increased prooxidant activity could well lead to the formation of lipid peroxides which are known to be toxic to many aspects of living systems. The role of tissue antioxidants in radiation therefore appears of importance but as yet is relatively unknown in spite of the well known role of oxidation reactions in the primary phases of radiation damage.

100 pages. $2.00.

A PRELIMINARY SURVEY OF THE PLANT MITES OF PUERTO RICO

(L. C. Card No. Mic 58-2378)

Harvey Leonard Cromroy, Ph.D.
North Carolina State College, 1958

Supervisor: Dr. Clyde Fuhriman Smith

This is a taxonomic study of the plant-feeding mites of Puerto Rico. These mites belong to the Class Arachnida, Order Acarina, Suborder Trombidiformes, and the families Tetranychidae, Tenuipalpidae, Tarsonemidae and Eriophyidae. General morphology, general biology and keys to species are given for each family as well as written and pictorial descriptions of the species.

Five additional species were added to the known list of tetranychids from the Island. One of these, Oligonychus smithi Cromroy, is described as a new species.

One species of Tenuipalpidae had been reported from the Island. Six additional species have been added to the list, three of which are described as new.

Twelve new species of tarsonemids are described. Also included are revised keys to the species of the genera, Steneotarsonemus and Tarsonemus, for the Western Hemisphere. A new genus, Fungitarsonemus, is erected to include the fungus-feeding species formerly included in the genus Hemitarsonemus.

Seven new species of Eriophyidae are described.

In addition, there is a host list cross indexed by mite species and by plant species. 277 pages. $3.60.

THE NEARCTIC MILTOGRAMMINAE (DIPTERA, SARCOPHAGIDAE) AND CERTAIN ALLIES

(L. C. Card No. Mic 58-2185)

William Lawrence Downes, Jr., Ph.D.
Iowa State College, 1958

Supervisor: Dr. Halbert M. Harris

Previous work on the North American Miltogramminae is out-dated and scattered. This study is an attempt to synthesize a more coherent picture of the subfamily, and to show the relationships of its members to the Sarcophagidae and other calyptrates.

Several hypotheses regarding the morphology of the calyptrates are defended, including the following: the suture between the vibrissa and the edge of the "mouth" cavity is part of the frontoclypeal suture; the inverted U-shaped sclerite on the anterior surface of the proboscis is a ventral part of the clypeus (an anteclypeus); the dorsal region of the clypeus comprises a major part of the facial plate; the so-called "rostral retractors" are actually rostral protractor muscles, and may be modified portions of the cibarial dilators; the posterior postabdominal segments of the male are "circumverted" (based on the looping of the abdominal nerve trunks around the hind gut).

Forty-four characters primitive with respect to the Calyptratae are listed. All but six of these characters are primitive with respect to the Sarcophagidae. Most of the modifications from the primitive state, such as the larger eye, the loss of the costal break at the tip of Sc, and the shorter body form appear to be correlates of a more rapid and agile flight. The relationships between visual acuity, facet size in and shape of the compound eye, and other factors are discussed.

The calyptrates are divided into seven families, the Oestridae (including Gasterophilus), Mormotomyiidae, Muscidae, Calliphoridae, Sarcophagidae, Rhinophoridae, and Tachinidae. The relationships among these families are obscure. The view that the Sarcophagidae are more closely related to the Calliphoridae than to other calyptrates is not well-founded.

Two subfamilies, the Sarcophaginae and Miltogramminae, comprise the Sarcophagidae. The Miltogramminae are subdivided into two tribes, and a key to the Nearctic miltogrammine genera is given. The other tribe is treated in greater detail, and includes Brachicoma (with 4 Nearctic spp.), Cattasoma (4 spp.), Erythrandra (2 spp.), Pseudosarcophaga (1 sp.), Sarcofahrtia (3 spp.), and Wohlfahrtia (1 sp.). Thirty nominal species have been erected for these species in the past, but 15 are junior synonyms. A closely knit group of genera including Glutoxys, Pseudopsodexia, and a third genus (formerly known under the names "Opelousia," "Opsodexia," etc.) are excluded from the Sarcophagidae, but are treated in detail (14 spp.) because of their importance in understanding calyptrate phylogeny.

Approximately 650 generic names belonging to or sometimes incorrectly placed with Sarcophagidae are listed. Synonymy and the correct family, subfamily, or tribal placement of the names are indicated. A list of sarcophagid family-group names with the earliest known date of proposal is included. 313 pages. $4.05.

THE CONTROL OF BOLL WEEVILS AND MITES IN RELATION TO THE ABSORPTION AND DISTRIBUTION OF A SYSTEMIC INSECTICIDE (THIMET) IN THE COTTON PLANT

(L. C. Card No. Mic 58-2379)

Jack Dent Early, Ph.D.
North Carolina State College, 1958

Supervisor: Dr. Clyde Fuhriman Smith

Greenhouse and laboratory experiments were conducted to determine the effect of Thimet seed treatment on the germination and growth of cotton plants grown in three different soil types and two moisture levels. No significant differences were found in germination between treated and untreated seed in either experiment. Height measurements made in the greenhouse experiment eight weeks after planting showed that Thimet-treated seedlings were taller than the untreated seedlings, while in the laboratory experiment the Thimet-treated seedlings generally did not perform as well as untreated seedlings.

In the greenhouse experiment, foliage injury appeared six weeks after planting and seedlings were rated according to the degree of injury. Thimet-treated seedlings had a significantly greater amount of leaf injury than did the untreated ones. Practically no foliage injury occurred on seedlings in the laboratory experiment.

Radioactive Thimet was synthesized to facilitate studies on the absorption, translocation and accumulation of Thimet in cotton plants and on the amount of Thimet insects must ingest to produce mortality. The highest rate of Thimet absorption from a soil-drench treatment occurred during the first hour after treatment. The initial concentration was highest in the growing tip and slightly less in the two oldest true leaves, but after two hours the concentration in the younger leaves had increased and equalized with that of the older leaves. There was then a general equal increase in concentration in the plant for the 512 hours. The growing tip consistently had the highest concentration of Thimet and its metabolites of all aerial portions of the plant.

In a similar experiment with cotton plants cultured in a radioactive Thimet solution, the fastest rate of absorption occurred during the first two hours, and redioautographs showed that Thimet and its metabolites tended to accumulate in the periphery of the leaves.

Five weeks after planting, cotton seedlings grown from treated seeds contained only 1.61 percent of the radioactive Thimet that had been applied to the seeds. A radioautograph showed that the highest concentration of Thimet and its metabolites was present in the cotyledons and the lower part of the hypocotyl. High concentrations were also present in the growing tip and the periphery of the true leaves.

The LD 50 for boll weevils, Anthonomus grandis Boh., fed on terminals of treated cotton was between 0.13 and 0.29 micrograms of Thimet and its metabolites per milligram of weevil.

Cotton grown from seeds treated with 8 pounds of Thimet per 100 pounds of seeds remained toxic to the two-spotted spider mite, Tetranychus telarius (L.), for 20 weeks while cotton grown in a 0.001 soil drench treatment remained toxic for 18 weeks. 72 pages. $2.00.

A POPULATION STUDY OF THE COTTONTAIL RABBIT IN SOUTHERN MICHIGAN

(L. C. Card No. Mic 58-2359)

Aelred Dean Geis, Ph.D.
Michigan State University, 1956

Cottontail rabbit (Sylvilagus floridanus) populations on two 500-acre areas, the Kellogg Bird Sanctuary and Farm, and the Kellogg Forest, were studied between June 1951 and April 1956. The areas are properties of Michigan State University and are located near Battle Creek, Michigan. Major objectives were:

1. Evaluate the accuracy of available census methods.
2. Appraise the effects of factors influencing rabbit abundance, especially hunting.
3. Analyze hunting pressure as it occured on a public area.

Live trapping was conducted almost constantly during the summer of 1951 on the Sanctuary study area. Trapping during the fall was conducted on both areas. At the Sanctuary spring trapping was conducted during 1952-1956. At the Forest, spring trapping took place only in 1955 and 1956. Trapped rabbits were marked with ear tags and in some cases also their tails were dyed yellow. Hunting was the chief means by which rabbits were collected.

An evaluation of census procedures indicated that the Lincoln Index method was reliable where rabbits were trapped and marked and then the marked fraction of the population determined by some other method than retrapping. Either shooting a sample or observing the tail colors was suitable. The De Lury method, based on the decrease in the hunting yield as the population was reduced, could not be applied at the Forest because the rate of kill did not decrease during the season. At the Sanctuary, the rate of kill decreased during the short and intensive hunting season, but the method consistently gave results that were about 50 percent low.

Several indexes of rabbit abundance were compared to Lincoln Index population estimates. The hunting kill made during a constant effort, and the total hunting kill appeared to be reliable population indexes. The rate of kill based on the total kill and effort was unreliable when hunting effort varied from year to year. Trapping data examined in various ways provided rough indexes of abundance at the Sanctuary, but showed very little relationship to population density at the Forest. Age ratios were reliable fall population indexes only during the few years when spring population levels were constant.

Fall population fluctuations at the Sanctuary between 1932 and 1955 and at the Forest for 1940 and for 1946-1955 were indicated by the hunting kills during fairly constant hunting pressures. No marked change in rabbit productivity has apparently occurred on either area during the periods considered. This is noteworthy since marked changes took place in the vegetation and predator populations on the two study areas.

On both study areas, autumn juvenile: adult ratios were inversely proportional to spring adult population levels. At the Sanctuary, the size of spring populations depended largely on the extent of the previous winter's hunting kill. At the Forest, the hunting kill took fairly constant percentage of the population and the size of the spring population was apparently related to the previous fall's population level.

Wide variation occurred in rates of population increase between spring and fall. High rates seemed to be associated with a better survival of early litters and a higher incidence of breeding among juveniles.

During the warm months an adult mortality of up to about 60 percent occurred. This not only influenced fall population levels but also caused fall age ratios to be exaggerated indexes of breeding success.

At the Forest the hunting bag for the 1951 season was 49 percent of the estimated population. During the other years it varied from 56 to 61 percent. At the Sanctuary the hunting kills ranged from 22 to 66 percent of the estimated fall populations depending upon the hunting pressure exerted. The hunting kill influenced the following spring population levels but apparently had little effect on the following fall populations.

Experiments were conducted to measure the crippling loss. Under experimental hunting conditions at the Sanctuary, it was roughly 10 percent of the recovered kill. With public hunting at the Forest it was about 20 percent.

The non-hunting winter mortality at the Sanctuary was estimated at from 29 to 54 percent of the rabbits not killed by hunting. It appeared to be higher during years which had a low hunting kill. The cause of this mortality was unknown.

The fall age composition at the Sanctuary over a five year period was 82 percent juveniles, 14 percent one and one-half years of age, and only four percent two and one-half or more years old. Heavy hunting kills apparently decreased the rate of survival indicated by the age composition.

Intensive live trapping was conducted between June 1951 and March 1952 and a life equation was determined for that period.

Because rabbits are a very important game animal the characteristics and effects of heavy public hunting were studied on the Kellogg Forest. Data were gathered when hunters checked out of the area after each hunt. Yearly, monthly, weekly, daily and hourly patterns of hunting effort, kill and rate of kill were determined. Hunting effort was high at the beginning of the season, rapidly tapered off, reached a second peak in early December and dwindled until it was uniformly low during the last four weeks of the season. The extent of the kill followed the trends in effort, except that it was relatively higher during late November and December when the rate of kill was higher. In general, the rate of kill early in the day was slightly higher than that later. Hunting effort was usually greatest about 11:00 A. M.

The entire kill was made by 19.6 percent of the hunters. Six and eight-tenths percent harvested 65.8 percent of the total kill. If there was a uniform probability of success it would be expected that 7.1 percent of the hunters would take 50.4 percent of the total bag. Significant differences

were found among hunters in the rate of kill. The distribution of effort among the hunters indicated that 85 percent hunted a total of less than six and one-half hours and 65 percent visited the area only once.

The influence of various weather factors on hunting effort was examined. Clear October days, cool November days, warm December days, calm days every month and November days with snow cover all seemed to induce an increased hunting effort. Rain fall caused a decrease in effort.

Hunters that had had previous experience with the area, who used dogs and/or who hunted on days with snow cover were much more successful than hunters without these benefits. Single hunters had a relatively higher rate of kill than did groups.

Increased hunting success prevailed when there was snow cover, on cool days in October and on warm days in December.

The rate of kill at the Forest did not decrease late in the season due to an increase in effort by experienced hunters, to an increased proportions of hunters that used dogs and a greater number of days with snow cover.

The probable effects of hunting seasons of various lengths were calculated. Lengthening the both ends of the current October 20 to January 31 season apparently would have little effect on junting effort, kill or success.

Great changes in vegetation and faunas have occured since Allen (Ecol. Mon., 8:347-436. 1938) studied the Sanctuary area during 1934-1937. These are discussed in detail.

Relative rabbit winter food preferences and availability of the various woody plant species on the area were listed.

208 pages. $2.70.

THE INFLUENCE OF TEMPERATURE AND EXPOSURE TIME ON THE EFFECTIVENESS OF CARBON DISULPHIDE AGAINST THE CONFUSED FLOUR BEETLE

(L. C. Card No. Mic 58-2149)

Muthuswamy Govindan, Ph.D.
University of Minnesota, 1958

This study was made of the influence of temperature and time of exposure on the effectiveness of carbon disulphide against confused flour beetle adults, Tribolium confusum Duv. A few comparative tests were made with the red flour beetle, Tribolium castaneum Hbst. The environmental temperatures were differentiated into periods of pre-fumigation, fumigation and post-fumigation.

When the insects were fumigated for 24 hours with 32 mgms./ liter of carbon disulphide (LD_{50} at 25° C. for a 24-hour exposure), there was a higher percent mortality at higher temperatures during fumigation. When the period of exposure was reduced to 6, 8, 10 or 12 hours, mortality occurred only at the higher temperatures (32° C.). Thus all experiments resulted in a positive temperature effect during fumigation.

The results obtained from post-fumigation temperatures indicated that the percent mortality was highest at the lowest and highest temperatures, while the lowest mortality occurred in a median range of 20° to 25° C. This result occurred when the insects were post-treated at 5, 10, 15, 20, 25, 30 and 35° C., after fumigation with carbon disulphide under reduced periods of exposures of 6, 8, 10 or 12 hours. This trend of effect resulting from post-fumigation temperatures occurred irrespective of availability or non-availability of food, of the two species studied, or short or long periods of post-treatment, or whether the insects were reared at 25°, 27°, or 35° C.

The effect of fumigation and post-fumigation temperatures was further examined by determining the degree of narcosis due to the effect of fumigant. The degree of narcosis was measured by determining the percent of Tribolium adults which failed to move away from a source of light. The narcotic effect correlated well with the mortality data for the effect of fumigation and post-fumigation temperatures of 5, 20 and 35° C.

In addition to the biological data, a colorimetric test was used for determining carbon disulphide. The test was not specific for carbon disulphide but did yield quantitative information on a carbon disulphide induced product found in the fumigated beetles. This has been referred to as the "CS_2 induced test (CIT)". Results of the CIT, based upon higher absorption values at higher temperatures, showed a positive trend for the effect of fumigation temperatures of 5, 20 and 35° C. and higher values at 5° and 35° C. than at 20° C. for post-fumigation temperatures. This relationship indicated that a carbon disulphide induced product or products was present in greater amounts at temperatures which resulted in the greatest narcosis and the highest percent mortality.

101 pages. $2.00.

SURVIVAL OF HONEY-BEE LARVAE FOLLOWING COLONY INOCULATION WITH VARIOUS DOSAGES OF BACILLUS LARVAE W.

(L. C. Card No. Mic 58-2190)

Joseph Charles Maurice L'Arrivee, Ph.D.
Iowa State College, 1958

Supervisor: Walter C. Rothenbuhler

This study was initiated to determine the relationship of various dosage levels of spores of Bacillus larvae White, causal organism of American foulbrood, to the percentage of larval mortality in colonies of honey bees (Apis mellifera L.). Such information would have considerable importance in a program of breeding for disease resistance or susceptibility.

Fifty-five small colonies of honey bees were subjected in four separate trials at different times of the year to one of seven dosage levels of Bacillus larvae spores. The spores were fed to colonies at the following concentrations: 0, $5x10^7$, $5x10^8$, $1x10^9$, $1x10^{10}$, $1x10^{11}$, and $1x10^{12}$ in one-half liter of 50 percent sugar syrup. A total of 54,315 honey-bee larvae were observed periodically during their development to ascertain survival.

The $5x10^7$ and $5x10^8$ dosages had no adverse effect on survival. Only one honey-bee larva dead of American foulbrood was found in one colony of nine which recieved the $5x10^8$ dosage. The $1x10^9$ and $1x10^{10}$ dosages resulted in a small incidence of disease but did not lower survival

The items following each abstract are: the number of manuscript pages in the dissertation and its cost on microfilm. Enlargements 5-1/2 x 8-1/2 inches, 4 cents per page. No postage is charged if check or money order accompanies order.

percentages significantly. On the other hand, the $1x10^{11}$ spore level was effective in substantially reducing the survival percentage of honey-bee larvae. The apparent high number of spores necessary to reduce significantly the percentage of surviving honey-bee larvae suggested the presence of a threshold effect. The highest dosage used in this study, the $1x10^{12}$ spore level, led to a 31 percent survival.

Two hypotheses for further testing are suggested by the data. The first is that nectar flow seems to have considerable influence on extent of mortality in colonies inoculated by the spores-in-syrup method. A large volume of incoming nectar dilutes the spore concentration of the inoculum, leading, apparently, to higher survival than that found in the absence of such a large nectar flow. The second is that sub-lethal dosages of the pathogen possibly exert a beneficial effect on survival rate. This higher survival, observed at the $5x10^{7}$ and $5x10^{8}$ dosage levels as compared to the spore-free checks, was not statistically significant but should not be discounted without further investigation. 63 pages. $2.00.

HISTOCHEMICAL STUDIES ON THE OVARY AND EGG-SHELL FORMATION IN THE FAIRY SHRIMP CHIROCEPHALOPSIS BUNDYI, (FORBES)

(L. C. Card No. Mic 58-2446)

Harris Joseph Linder, Ph.D.
Cornell University, 1958

In the ovary of the fairy shripm Chirocephalopsis bundyi four cell types can be identified (a) follicle cells which constitute the outer wall of the ovary, (b) germinal cells, (c) nutritive cells, and (d) oocyte. The nutritive cells and oocytes arise by proliferation of the germinal cells in the germarium, and are limited to a region of the ovary known as the vitellarium.

Histochemical study of the oocytes reveals the presence of carbohydrates, proteins, and lipids. Carbohydrates are mainly in the form of glycogen although they may contribute to the weak PAS reaction of the yolk droplets. Arginine is confined to the acidophilic yolk droplets and is no doubt a factor contributing to the acidophilia. The yolk droplet, therefore, is believed to be a protein-carbohydrate complex. Sudanophilic neutral lipids are present as coarse granules dispersed in the spaces between the numerous yolk droplets.

In view of the observations that yolk droplet formation and lipid syntheses begin during phagocytic vitellogenesis it appears probable that the oocytes derive the necessary raw materials for vitellogenesis from the nutritive cells. Glycogen on the other hand is apparent much earlier in the growth of the oocyte and is no doubt synthesized endogenously from glucose passing through the follicular epithelium from the hemocoel.

The passage of eggs through the lateral pouches of the oviduct into the ovisac is facilitated by a PAS positive mucus-like secretion liberated by the oviduct epithelium. Eggs confined to the ovisac are surrounded by two membranes. The outer membrane or tertiary shell is derived from secretions of the shell glands. The inner membrane which contains chitin is laid down by the cells of the blastoderm after the tertiary shell has been deposited.

Unlike the lateral pouch which originates as an outgrowth from the ovary, the ovisac is considered to be an ectodermal derivative. The wall of the ovisac secretes a globular PAS material which covers the outer tertiary shell. A blue pigment accumulates around the ovisac wall and shell glands. This pigment is believed to be a carotenoid-protein complex, the protein moiety derived from the blood cell secretions. The function of this pigment, if any, is unknown.

The shell glands arise as outgrowths from the walls of the ovisac and are considered homologous to the tegumental glands of other crustaceans. The shell gland secretion, considered by previous investigators as a product of nuclear degeneration, does not arise from the nucleus but is synthesized in the cytoplasm during a single secretory cycle. It is gradually released into the ovisac throughout the life of the shrimp.

Histochemical reactions of the shell gland secretion reveal the presence of a lipoprotein complex. The lipid moiety is believed to be a chromolipoid derived from the oxidation of phospholipid. The intense basophilia of the secretion is considered the result of numerous carboxyl groups set free during this oxidation. Tyrosine is a major consitutent of this lipoprotein. Presumably by the spontaneous oxidation of the phenolic groups of tyrosine, quinone-like substances are formed which couple with adjacent reactive groups in the molecule and hence harden the egg shell. No polyphenol oxidase or free di-phenolic derivatives of tyrosine, like that found in the insects, could be detected during egg shell formation and hardening in C. bundyi. The stabilization of the lipoprotein complex into a rigid outer shell, therefore, appears to be the result of a primitive auto-quinone tanning system. A similar means whereby a lipoprotein complex is "auto-tanned" to form a fairly rigid substance can be found in the cuticle of Chilopods and Diplopods during the formation of pro-sclerotin and in the cuticulin layer of Periplaneta before final impregnation with free quinones. 154 pages. $2.05.

CHEMICAL, BIOLOGICAL, AND RESIDUE DISSIPATION EXPERIMENTS WITH THIODAN

(L. C. Card No. Mic 58-2192)

Donald Arthur Lindquist, Ph.D.
Iowa State College, 1958

Supervisor: Dr. Paul A. Dahm

Thiodan (6, 7, 8, 9, 10, 10-hexachloro-1, 5, 5a, 6, 9, 9a-hexahydro-6, 9-methano-2, 4, 3-benzodioxathiepin-3-oxide), an experimental, heterocyclic, sulfur-containing, cyclodiene insecticide, was the subject of chemical, biological, and residue dissipation investigations.

Technical Thiodan is apparently a mixture of two isomers; these isomers were separated successfully by column and paper chromatography. Ultraviolet and infrared spectra were obtained of Thiodan, its two isomers, and Thiodan alcohol, 1, 4, 5, 6, 7, 7-hexachloro-2, 3-bis (hydroxymethyl) bicyclo- [2. 2. 1] heptene-5. The final step

in the synthesis of Thiodan, involving the reaction of Thiodan alcohol with thionyl chloride, was carried out successfully. Experimental evidence indicates only one isomer of Thiodan alcohol, therefore, it is proposed that during the reaction of Thiodan alcohol with thionyl chloride a rearrangement occurs to form two stereoisomers of Thiodan.

When applied topically to female house flies (Musca domestica L.), the estimated LD_{50} values were: Thiodan - 0.15, Thiodan isomer A - 0.14, Thiodan isomer B - 0.19, and p, p'-DDT (1, 1, 1-trichloro-2, 2-bis (p -chlorophenyl) ethane) - 0.21 μg. per fly. The acute oral LD_{50} value of Thiodan in corn oil to male white rats (albino form of the Norway rat, Rattus norvegicus (Erxleben)) was between 40 and 50 mg. per kg. of rat body weight.

The persistence of Thiodan residues was studied on corn plants treated for European corn borer (Pyrausta nubilalis (Hbn.)) control with a water emulsion formulation at a rate of 1.5 lbs. of Thiodan per acre and a 5% Thiodan granulated formulation at a rate of 1.0 lb. of Thiodan per acre. Samples of corn were collected during a 9-week period after treatment; these samples were chopped, extracted, and the extracts analyzed for Thiodan by three analytical methods: titrimetric organic chlorine, colorimetric sulfur dioxide evolution, and house fly bioassay.

The initial residue was much higher on the emulsion treated corn than on the granular treated corn. However, from 1 week after treatment until the experiment was terminated, only slight differences were found in the Thiodan residues on the two treatments. The residue study showed that the granulated formulation of Thiodan persisted on the corn plants as long as or longer than the emulsion formulation. This study also indicated that a compound, other than Thiodan, was present on the later residue samples. 70 pages. $2.00.

INFLUENCE OF A VITAMIN K ACTIVE SUBSTANCE ON INFECTIONS OF EIMERIA TENELLA IN CHICKENS

(L. C. Card No. Mic 58-2196)

Wilford Lee Nusser, Ph.D.
Iowa State College, 1958

Supervisor: Dr. Elery R. Becker

A series of nine experiments was completed using a total of 192 five-week-old hybrid male chickens. These chickens were divided into two equal groups, and inoculated with 25,000 to 50,000 sporulated oocysts of Eimeria tenella, according to weight. Birds of one group in each experiment were given an aqueous solution of menadione sodium bisulfite ("Klotogen F"), a vitamin K active material, orally on the day of inoculation and for three successive days following inoculation. These birds, designated as Group 1 infected-treated birds, received 3.125 mg of menadione sodium bisulfite in solution daily for four days, or a total of 12.5 mg. The remaining birds, designated as Group 2 non-treated infected birds; received no drugs prior to, or following inoculation. Both groups were kept on a basal diet which supplied approximately the minimum daily requirement of vitamin K. Studies were made on the following aspects of infection and treatment: mortality rate; hemoglobin concentration; prothrombin time; and histopathology.

Twenty-eight (29.1%) of the Group 1 birds died. All deaths were attributed to cecal coccidiosis. Fifty-seven (59.3%) of the Group 2 birds died. Birds receiving menadione sodium bisulfite had a 50 percent lower mortality rate than did non-treated birds. These results were significant by Chi square analysis.

Hemoglobin studies indicated that oral administration of menadione sodium bisulfite in the dosage used had no recordable effect on hemoglobin concentration in birds infected with E. tenella. The hemoglobin concentration of treated and non-treated birds was practically equal on the fifth day following inoculation.

Prothrombin time was recorded for all birds. Thromboplastin was prepared from chicken brain as a saline extract, and used in all experiments except the first experiment in which a commercial preparation was used. The data on this experiment were not included. The combined prothrombin time for Group 1 was 4128 seconds, or a mean of 60.1 seconds prior to inoculation. The combined time for Group 2 birds prior to inoculation was 3615 seconds, or a mean of 53.9 seconds. A second determination was made usually on the fifth day following inoculation. Prothrombin time for treated birds was 2254 seconds, or a mean of 37.6 seconds. This was a decrease of 22.5 seconds. Group 2 birds had a prothrombin time of 2531 seconds and a mean of 40.2 seconds. This was a decrease of 13.7 seconds. The treated birds showed a mean decrease of 8.8 seconds below that of the non-treated birds.

Microscopic examination of tissue sections indicated that less severe hemorrhage had occurred in treated birds than in non-treated birds.

It was concluded that additional vitamin K in the form of a vitamin K active substance helped reduce mortality in infected, treated birds by reducing the severity of cecal hemorrhage. Other factors as yet unexplained were probably instrumental in causing death in treated birds showing a low prothrombin time. 109 pages. $2.00.

STUDIES ON THE MODE OF ACTION OF INSECTICIDES

(L. C. Card No. Mic 58-2197)

Chandra Prakash Pant, Ph.D.
Iowa State College, 1958

Supervisor: Dr. Paul A. Dahm

The in vivo effects of a series of insecticides, on cytochrome oxidase, succinic dehydrogenase, over-all glycolysis and distribution of P^{32} -labeled metabolites involved in biological energetics, were studied using the house fly, Musca domestica L. as the test insect. Techniques are described for measurement of the activity of cytochrome oxidase, succinic dehydrogenase, over-all glycolysis, incorporation of P^{32} into the house fly tissue and subsequent extraction, chromatographic separation and radiometric scanning of P^{32} -labeled metabolites.

Cytochrome oxidase activity was inhibited by hydrocyanic acid gas, carbon disulfide, and Dipterex (0,0-dimethyl

2,2,2-trichloro-1-hydroxethyl phosphonate). A stimulation in the activity of this enzyme was noted with ethylene dibromide (1,2-dibromoethane), ethylene dichloride (1,2-dichloroethane) and pyrethrum extract. DDT (1,1,1-trichloro-2,2-bis(p-chlorophenyl) ethane) did not have any effect on the activity of this enzyme.

Succinic dehydrogenase was inhibited by ethylene dibromide, ethylene dichloride, pyrethrum extract, DDT and Dipterex. A stimulatory effect was noticed with carbon disulfide.

Over-all glycolytic activity was inhibited by ethylene dibromide, carbon disulfide, pyrethrum extract and Dipterex. Hydrocyanic acid gas produced a stimulatory effect on over-all glycolytic activity.

The P^{32}-labeled metabolites separated by paper chromatography were insoluble phosphoproteins (fraction I), ATP + ADP (fraction II), sugar phosphates + adenosine monophosphate + arginine phosphate (fraction III), 3-phosphoglyceric acid (fraction IV), and inorganic (ortho) phosphate (fraction V). The ratio of ATP + ADP to inorganic phosphate which was taken as an index of the over-all production of high energy bonds, was 1.15 in the untreated, control house flies. The fraction containing 3-phosphoglyceric acid was absent in the control flies.

Hydrocyanic acid caused a depletion of the ATP + ADP fraction; the ratio of this fraction to inorganic phosphate was 0.15. The appearance of a 3-phosphoglyceric acid fraction confirmed the stimulatory effect of hydrocyanic acid on glycolytic activity. Ethylene dibromide and ethylene dichloride caused no abnormal effects on the distribution of the P^{32}-labeled metabolites. Carbon disulfide, pyrethrum extract (film), DDT and Dipterex also caused a reduction in the ATP + ADP fraction, the corresponding ratios of this fraction to inorganic phosphate being 0.44, 0.45, 0.51, and 0.82 respectively. In the case of house flies treated with Dipterex, 3-phosphoglyceric acid was present, indicating some other pathway involving 3-phosphoglyceric acid in the house fly intermediary metabolic scheme. 81 pages. $2.00.

ECOLOGICAL OBSERVATIONS ON ACARINE POPULATIONS OF RODENT BURROWS IN THE EGYPTIAN DESERT

(L. C. Card No. Mic 58-2230)

Conrad Erhardt Yunker, Ph.D.
University of Maryland, 1958

Supervisor: Professor G. W. Wharton

A study was made of the environment and populations of ectoparasitic Acarina of Egyptian gerbils, Gerbillus g. gerbillus (Olivier) and G. p. pyramidum Geoffroy, which inhabit desert and semi-desert burrows near Cairo. Collections were made twice each week during morning hours throughout four time-segments of the year September, 1956 - August, 1957.

Burrows were excavated, arthropods collected, hosts examined, and observations on the climate of the area and microclimate of the burrows were made. A 24-hour period was spent in the field, once during each study-period, to record diurnal climatic and microclimatic fluctuations.

Burrows of both species were similar, but differences were noted within burrows of each area. Semi-desert burrows did not reach the average depth of desert burrows during the wet-cold season, and had 10 - 22 per cent higher average relative humidity values than did desert burrows. The semi-desert burrow contained more numbers and kinds of associated arthropods than did the desert burrows, and the former was usually made by G. g. gerbillus, while the latter was made by G. p. pyramidum. Both types of burrows were shown to have microclimates different than the external climate. Burrow temperatures and relative humidities did not approach the diurnal extremes of the exterior, and were more stable.

The presence or absence and total numbers of mites in a burrow were statistically analyzed (by use of chi-square values obtained from fourfold and R x C tabulation) according to four environmental factors: presence or absence of a host, area, time of year, and climatic state of the burrow as exemplified by vapor pressure deficit value. Various species of mites were analyzed according to area or host specificity and according to whether they were nest-dwellers or permanent parasites.

The total number of mites found throughout the study was 3,214, comprising 17 - 18 species, one of which is new. Most of these belong to the families Laelaptidae or Dermanyssidae. Haemolaelaps aegyptius Keegan, Androlaelaps marshalli Berlese, Hirstionyssus craticulatus Keegan, and Haemolaelaps insculptus Keegan, respectively were present more often and in highest numbers. Two genera of ticks, Rhipicephalus and Hyalomma, representing 212 specimens of 2 - 4 species, were found. Free-living arthropods numbered over 600 specimens of 13 different orders.

The presence or absence of mites in a burrow depended upon the occupancy of the burrow by the host. Significantly more burrows were found with mites than without if the host were present, or absent for less than a day. When the host was absent for more than a day, the opposite was true. Area in which the burrow was located affected population size, either by reducing it in the desert or by increasing it in the semi-desert.

Androlaelaps marshalli showed no host specificity, but was usually restricted to semi-desert burrows. The distribution of Haemolaelaps aegyptius and Hirstionyssus craticulatus was independent of host species and area. H. craticulatus and the ticks were completely dependent upon the presence of a host.

The effective environment of the parasitic mite populations is the burrow and the host. They are mostly nest-dwellers and are never exposed to the external environment. The ticks are free from the host and the burrow at various times and are thus exposed to the external environment. This is reflected in a definite correlation of tick abundance with seasonal events, while a similar correlation is not apparent in the mites.

The burrow is better suited than the exterior as an environment of mite populations. The microclimate is different and vastly more stable than the macroclimate; and its fluctuations are opportune for behaviorial demands of mite populations. 199 pages. $2.60.

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DISSERTATION ABSTRACTS

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